


MARICOPA ASSOCIATION of GOVERNMENTS

SYSTEM PERFORMANCE REPORT

2020

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Our Changing Transportation Landscape

How we get around.
The number of people using our transportation system continues to grow as our region expands. As we continue to put stress on our existing infrastructure, creative and efficient methods of moving people around the Valley will be essential.

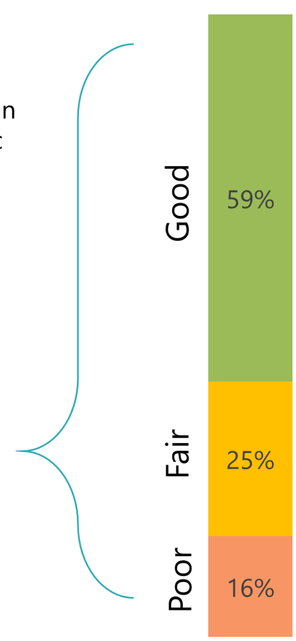
124 million
Vehicle Miles Traveled in 2018

69 million
Transit Riders in FY2018

23.8%
Non-SOV Travel

What does this mean?
Non-SOV stands for Non-Single Occupancy Vehicle. The percentage to the left represents the number of trips in our region that were taken using public transportation, carpool, vanpool, telecommuting, walking, or bicycling.

Arterial Pavement Condition



Pavement Condition
Cities around the Valley collect data on the condition of the pavement within their boundaries. Pavement condition can negatively impact the wear and tear and on our vehicles and even our MPGs.

Loop 202 (South Mountain)
In December 2019, The final section of the Loop 202 opened for traffic. While some commuters and roadway users probably felt an immediate impact, data to analyze just how big that impact might be won't be available until late 2020.

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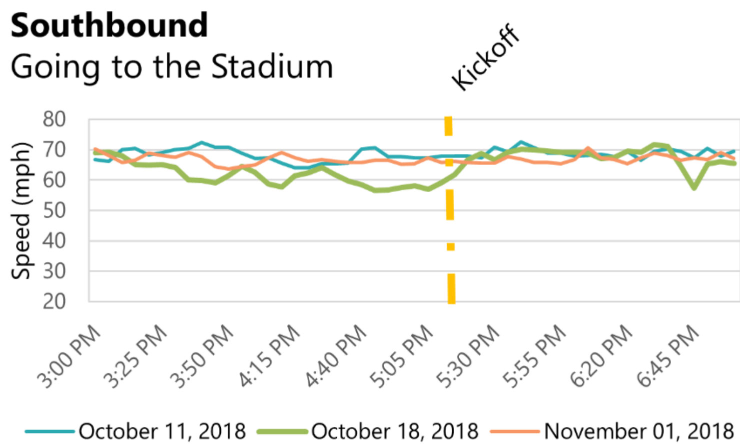
Data Sources: HERE Traffic Data, MAG Travel Demand Model, Valley Metro Performance Reports

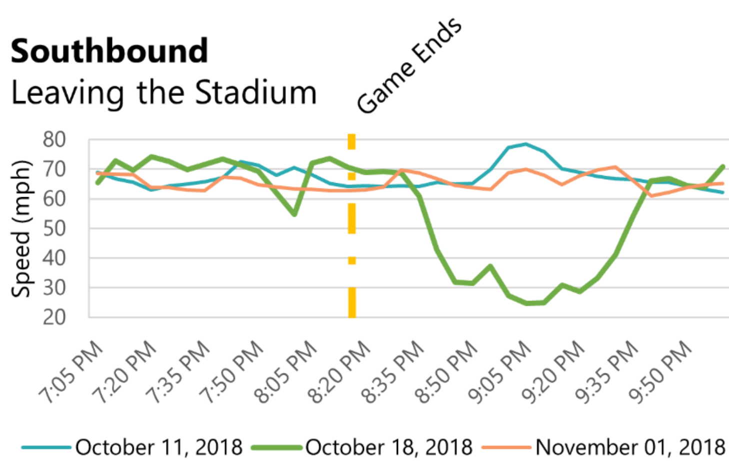
Non-recurring Congestion

Not Your Everyday Traffic

Thursday, October 18th, 2018 – Arizona Cardinals vs. Denver Broncos
Arizona Cardinal Football games are a good example of non-recurring congestion. To highlight this, we have analyzed INRIX data using the RITIS Probe Data Analytics Suite to highlight the impact a game has on our system.



What does this mean?
In the chart above, we've highlighted kickoff so that you can see the steady decline in speeds as we get closer to game time. The speed, in Miles Per Hour, is consistently lower on game days.



After the Game
Immediately following the game, there is a very visible decrease in speed on the Loop 101 as an estimated 60,000 fans try to get home.

66.4%
Reduction in Speed

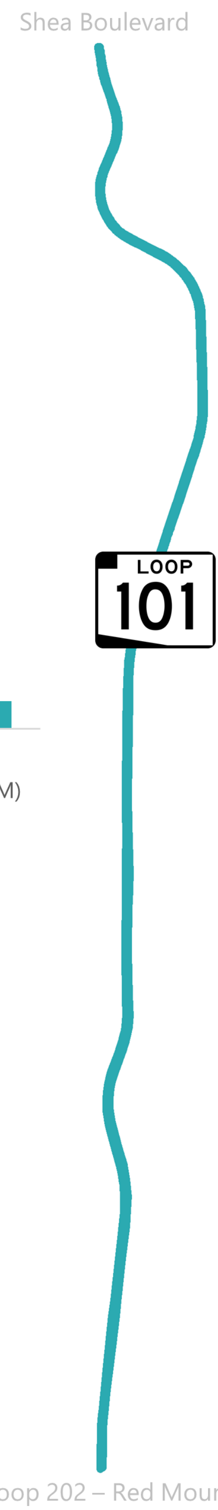
Data Sources: INRIX Traffic Data. For more information, please see the Non-Recurring Congestion section of this report.

Project Spotlight

Loop 101 (Pima): Shea Boulevard to the Loop 202 (Red Mountain)

Project Description:
This project constructed an additional general purpose lane in both directions of Loop 101 (Pima Freeway) between Shea Boulevard and the Loop 202 (Red Mountain Freeway).

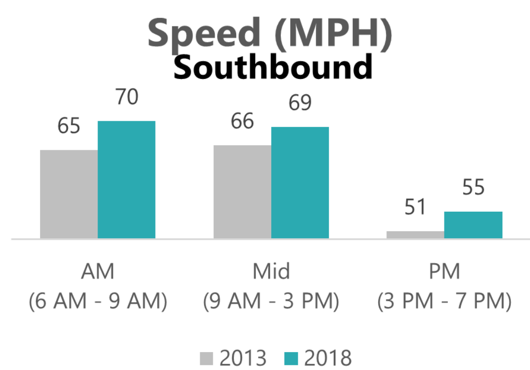
After Construction:
10,000
Additional Drivers
22 miles
Of Additional Lanes

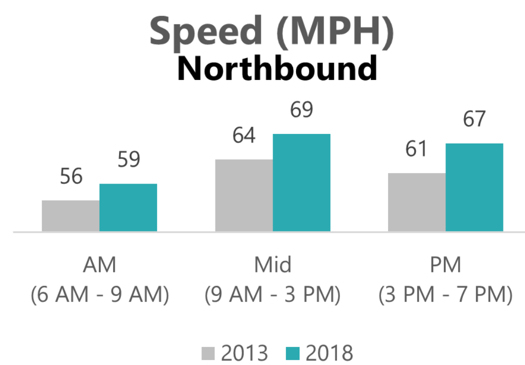


2007
Design Concept Report

Fall 2014
Construction Begins

Summer 2016
Open to Traffic





6.4%
Increase In PM Speed

5.7%
Increase In AM Speed

Summary:

- **More** travelers
- **Faster** travel
- **Improved** reliability

This project was funded through Proposition 400, a half-cent sales tax passed by Maricopa County voters in 2004.

Data Sources: HERE Traffic Data, MAG Traffic Counts, ALISS Crash Data

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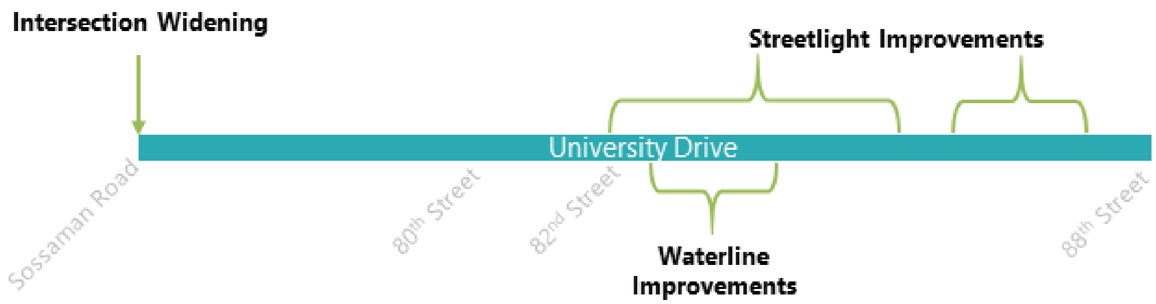
Project Spotlight
University Drive: Sossaman Road to 88th Street

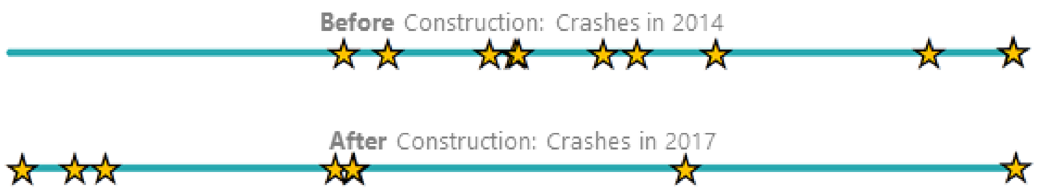
FY15/16
Design

June 2016
Construction Begins

December 2016
Open to Traffic

Project Description:
This project widened the intersection of University and Sossaman Road and reconstructed the roadway along the segment limits as the pavement was in need of rehabilitation. This project also brought the facility into complete street design compliance and addressed ADA issues along the alignment.





After Construction:

23%
Increase in Traffic Volumes

Eastbound
11%
Improvement in Reliability

Westbound
14%
Improvement in Reliability

How do we measure reliability?
Travel Time Index is calculated by comparing how long it takes a driver to travel through a corridor when it has no traffic and when it is at it's most congested. The two numbers are used create a ratio that represents how reliably a driver can move through a corridor in a projected amount of time.

Data Sources: HERE Traffic Data, MAG Traffic Counts, ALISS Crash Data

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This project was funded through Proposition 400, a half-cent sales tax passed by Maricopa County voters in 2004.

Introduction

Transportation Performance Program

In order to make better, data-driven decisions, MAG has redeveloped its Transportation Performance Program to better meet the shifting demands of today's transportation needs.

The program continues to revolve around its two main functions:

1. To meet federal requirements for performance measurement.
2. To assist MAG in project evaluation and prioritization.

The first item requires collaboration with our transportation partners and is guided by a variety of federal statutes outlined in Appendix A. The second, requires coordination with our member agencies and many divisions within MAG. Both elements require large datasets and a comprehensive understanding of their use and limitations. Background on the datasets used by the Transportation Performance Program can be found in Appendix B.

MAG's performance measurement program began in earnest in 2008 with the development of the Performance Measurement Framework and Congestion Management Update Study. Prior to that, performance-like activities were still conducted though in a less formalized fashion. A comprehensive history of performance measures at MAG can be found in Appendix C.

The System Performance Report

The goal of this document is to provide a brief report on the performance of the existing transportation system within the MAG region. Information about the system will be provided at multiple scales and for various modes in an attempt to provide a holistic picture of transportation within the region. Our goal is to be both thorough and comprehensive while focusing on the larger transportation picture.

System-Level Performance

Federal Performance Targets

The current federal performance targets focus solely on metrics at the system-level. Three groups of transportation performance measures and two transit specific measures have been mandated. With each roadway-specific performance measure, a Metropolitan Planning Organization (MPO) can decide to support the targets set by the state or they can elect to develop their own. MAG has elected to calculate some targets, specific to the MAG planning area, and support other statewide targets as noted below. For the transit-specific measures the MPO can elect to support the targets of it's providers or develop regional targets. MAG has not developed regional transit targets at this time.

PM1 – Safety Performance Targets

The Arizona Department of Transportation (ADOT) is required to submit established safety targets with their annual Highway Safety Improvement Program (HSIP) report to the Federal Highway Administration (FHWA). On August 31, 2012 the Arizona Department of Transportation (ADOT) formally established safety targets for the state of Arizona for 2021. These safety targets are based on the Safety Performance Measures established by the FHWA Safety Performance Management (Safety PM) final ruling and are based on five-year rolling averages.

The data below is compiled by the Arizona Department of Transportation (ADOT). Each year ADOT presents this information to MAG's policy committees. The committees must decide to support the state targets or develop MAG specific projections. To date, MAG has elected to support ADOT's statewide targets.

Safety targets established by ADOT are as follows:

S1: Number of Fatalities

The declining number of vehicle miles traveled (VMT) during The Great Recession resulted in a likewise decline in number of fatalities statewide. As VMT steadily rose, the number of fatalities also increased as shown in Chart 1.

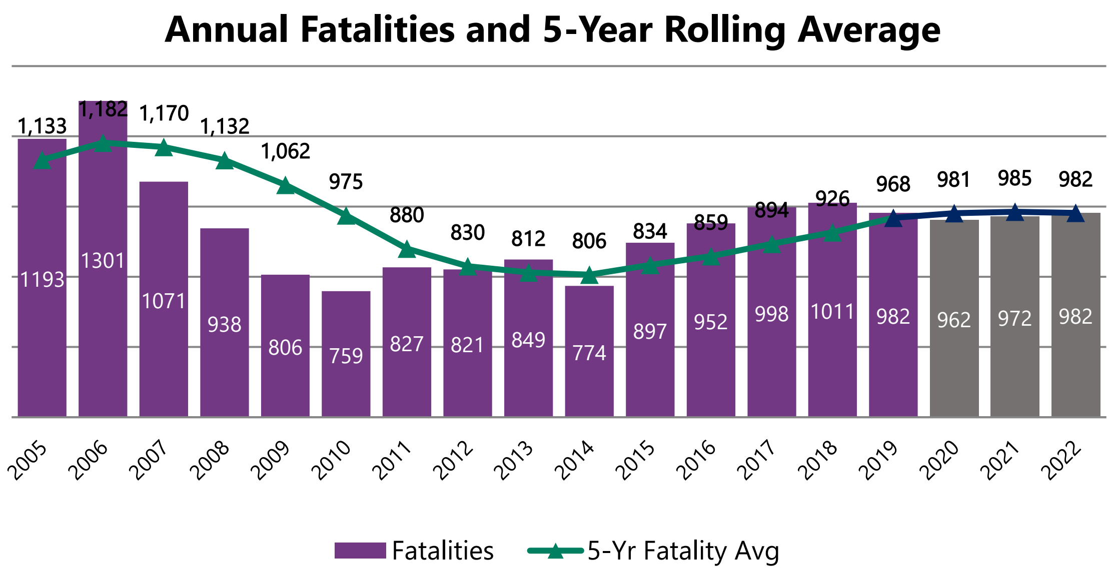


Chart 1 - Actual and Projected Number of Fatalities 2005-2022. Source: ADOT

S2: Fatalities per 100 Million Vehicle Miles Traveled

Using a rate rather than the absolute number allows us to take into consideration the population growth our region has experienced.

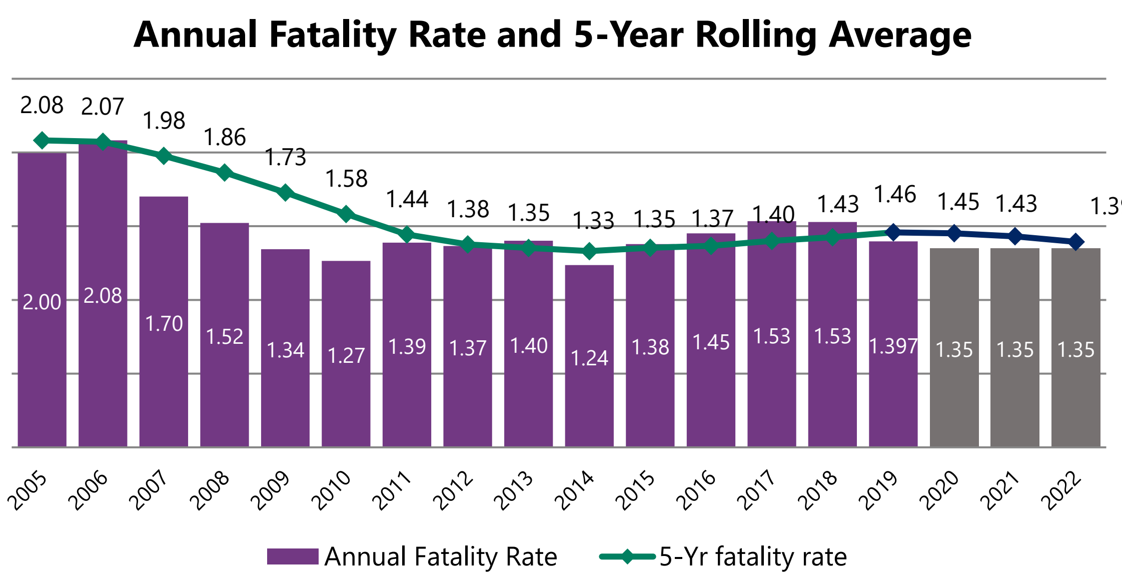


Chart 2 - Actual and Projected Rate of Fatalities 2005-2022. Source: ADOT

S3: Number of Serious Injuries

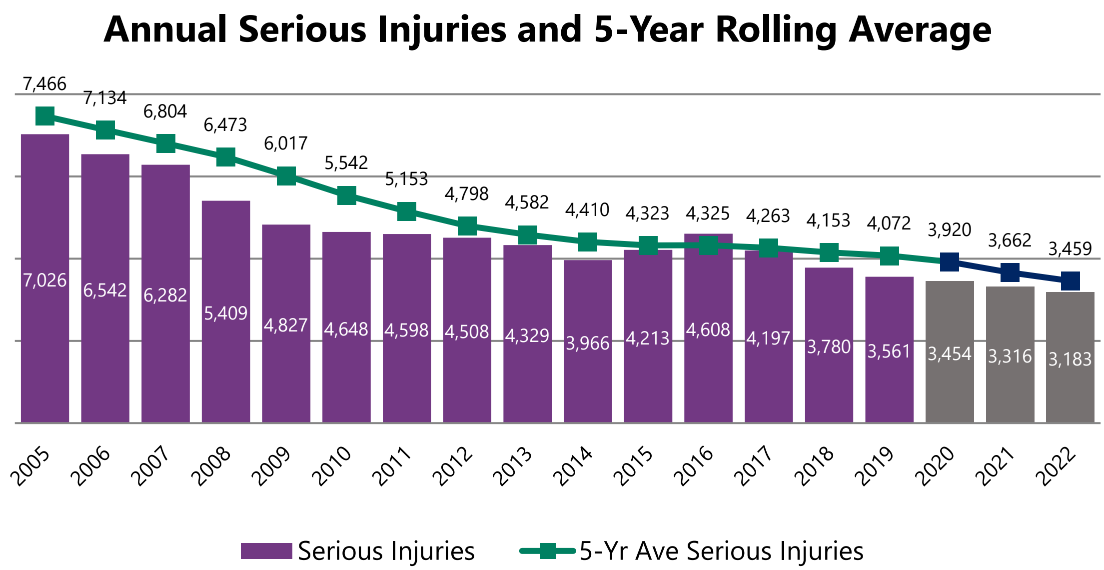


Chart 3 - Actual and Projected Number of Serious Injuries 2005-2022. Source: ADOT

More information about the definition of "serious injury" can be found here: https://safety.fhwa.dot.gov/hsip/spm/docs/factsheet-mmucc-4edition.pdf

S4: Serious Injuries per 100 Million Vehicle Miles Traveled

As with fatalities, using rate rather than absolute numbers helps account for population growth.

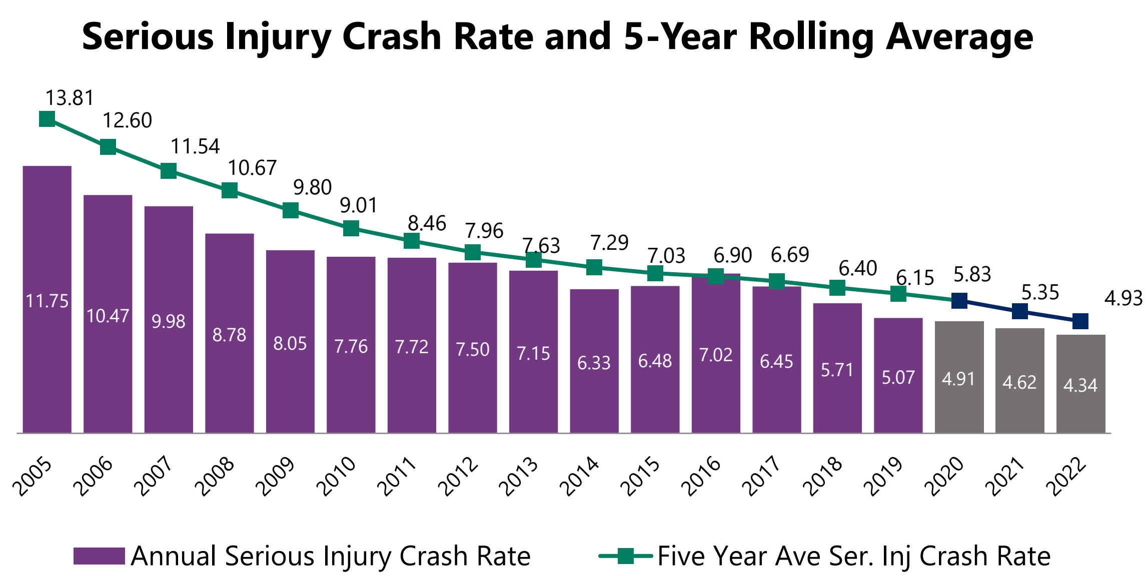


Chart 4 - Actual and Projected Rate of Serious Injuries 2005-2022. Source: ADOT

S5: Number of Non-motorized Fatalities and Non-motorized Serious Injuries

Non-motorized fatalities are a high priority for both the state and the MAG region. A recent report from the Governors Highway Safety Association placed Arizona as the fifth worst state in the nation in terms of pedestrian deaths[1].

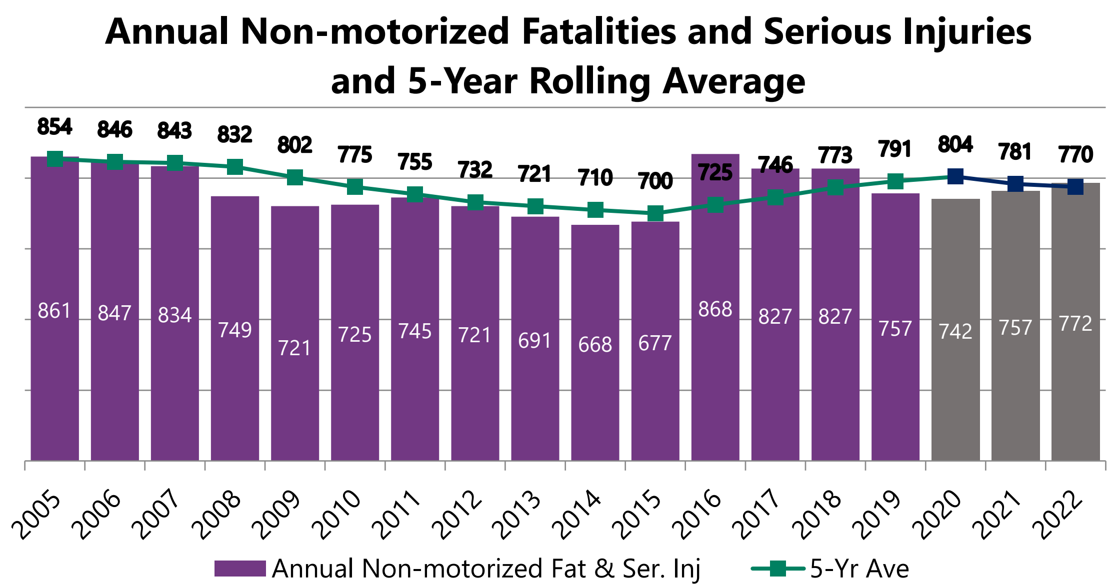


Chart 5 - Actual and Projected Number of Non-motorized Fatalities and Serious Injuries 2005-2022. Source: ADOT

More information on MAG's safety efforts can be found here: https://www.azmag.gov/Programs/Transportation/Safety-Programs

Target Setting

The safety targets set by ADOT are data-driven and realistic. They are intended to keep the State focused on improving safety while still striving for the goals of the MPOs regional Strategic Transportation Safety Plans (STSPs) and the State Strategic Traffic Safety Plan (STSP) of reducing the number of traffic fatalities and serious injury crashes in Arizona.

MPOs are required within 180 days of the effective date to indicate to ADOT whether the MPO supports the State target or identify their own targets. MPOs can adopt the safety targets in perpetuity, or until the MPO should deem it necessary to establish and adopt their own targets. Since the State established targets are closely tied to the ADOT administered federal aid Highway Safety Improvement Program (HSIP), and MPO targets are not included in the assessment of whether a State met or made significant progress toward meeting its targets, ADOT recommends that MPOs support the state targets.

MAG is committed to doing the following:

[1] https://www.ghsa.org/sites/default/files/2019-02/FINAL_Pedestrians19.pdf Accessed 1/30/2020.

- Continue to administer the newly established MAG Roadway Safety Program (RSP) to fund low-cost safety improvements as a supplement the State's HSIP. This new funding program provides local agencies the flexibility to implement near-term safety improvements in an expedited manner.
- Work with the State and safety stakeholders to address areas of concern for fatalities or serious injuries within the metropolitan planning area.
- Coordinate with the state and include the safety performance measures and HSIP targets for all public roads in the metropolitan area in the Regional Transportation Plan (RTP).
- Integrate into the metropolitan transportation planning process, the safety goals, objectives, performance measures and targets described in state safety transportation plans and processes such as applicable portions of the HSIP, including the AZ-STSP. Include a description in the Transportation Improvement Plan (TIP) of the anticipated effect of the TIP toward achieving HSIP targets in the RTP, linking investment priorities in the TIP to those safety targets.

PM2 – Bridge and Pavement Condition

The second set of performance measures required the establishment of pavement and bridge condition targets for the interstate and non-interstate National Highway System (NHS). Targets were established by ADOT in May of 2018 and communicated to MPOs at that time. The official reporting date to Federal Highway Administration (FHWA) was October 1, 2018. The first opportunity to revise these targets will be October 1, 2020.

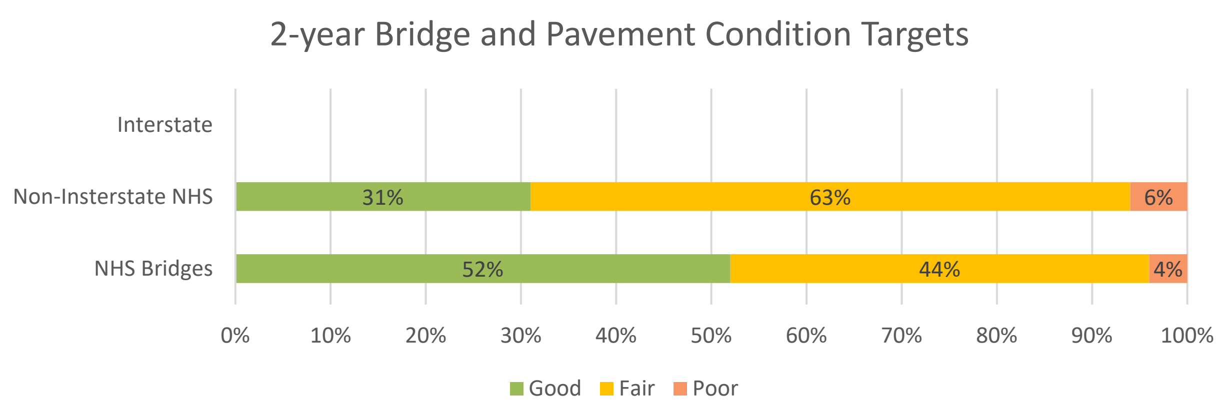
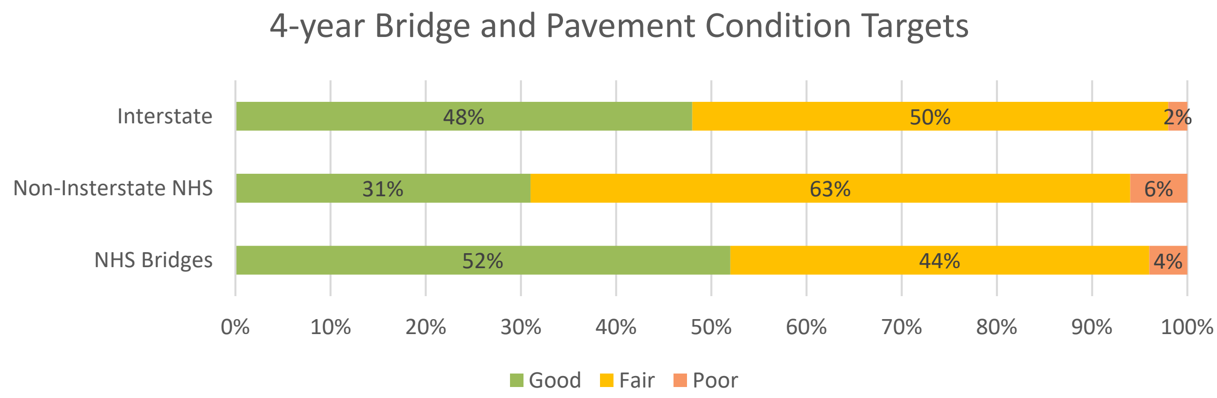


Chart 6- 2-year Bridge and Pavement Condition Targets. Source: ADOT



To provide some context, MAG's NHS roadways represent 16% of the total non-Interstate NHS roadway lane miles in the state and MAG's bridge deck area is 3.1% of the total state NHS bridge deck area.

PM3 – System Reliability

In collaboration with ADOT, MAG's Transportation and Environmental Divisions developed methodology for and calculated several reliability and emission measures as part of PM3.

	ADOT		MARICOPA ASSOCIATION of GOVERNMENTS	
Measure	2-Year Target	4-Year Target	2-Year Target	4-Year Target
Travel Time Reliability - Interstate System	85.83%	85.70%	67.84%	64.28%
Travel Time Reliability - Non-Interstate NHS	79.22%	74.90%	69.95%	61.11%
Truck Travel Time Reliability Index	1.2	1.23	1.47	1.5
Peak Hour Excessive Delay Per Capita	8.8 Hours	10.9 Hours	8.8 Hours	10.9 Hours
% Non-SOV Travel	22.90%	22.60%	22.90%	22.60%

Table 1 - System Reliability Measures 2-year & 4-year Targets. Source: MAG & ADOT

The targets above speak to the reliability of our transportation system. Each measure speaks to a different facet of transportation:

- Travel Time Reliability – This target represents the percentage of miles that are reliable. Incidents, weather events, and congestion can play a large part the level of reliability one can expect.
- Truck Travel Time Reliability – Produced from the National Performance Management Research Data Set, this target addresses the reliability of travel time for trucks on the Interstate system.
- Peak Hour Excessive Delay Per Capita (PHED) – this target is measured by the annual hours of excessive delay per capita on the National Highway System.

- Percent of Non-Single Occupancy Vehicle (SOV) Travel – This percentage is taken from the American Community Survey commuting data.

Unlike PM1 and PM2, MAG has set specific targets for our region.

PM3 also requires the establishment of emission reductions targets. These targets were developed by MAG's Environmental Division and supported by MAG's policy committees. In the table below the targets for reducing Volatile Organic Compounds (VOC), Carbon Monoxide (CO), Nitric Oxide (NOx), Particulate Matter that is 10 microns or less (PM-10), and Particulate Matter that is 2.5 microns or less (PM-2.5) are displayed.

MAG Targets (kg/day)	VOC	CO	NOx	PM-10	PM-2.5
2-Year Target (FY2018-2019)	210	3720	418	873	69
4-Year Target (FY2018-2021)	385	6985	761	1399	112

Table 2 - Air Quality and Emission 2-year & 4-year Targets. Source: MAG

For more information on MAG's emission reduction efforts, please visit
https://www.azmag.gov/About-Us/Divisions/Environmental-Division

Transit Asset Management (TAM)

Since 2018, transit providers who receive Chapter 53 federal funds have been mandated to create a Transit Asset Management plan. The goal of a TAM plan is to help agencies manage their assets operationally and financially.

There are two tiers of providers with different reporting requirements. Tier I providers represent a transit provider with more than 100 vehicles in their fleet. For 2020, three agencies in the MAG region meet that threshold: Valley Metro, the City of Phoenix and the City of Tempe. Other agencies providing transit, but below that threshold, are known as Tier II providers. Tier II providers may be covered under the state TAM plan.

To address the requirement that MPOs must develop regionwide TAM targets, MAG has established a working group comprised of the Tier I agencies and ADOT to coordinate TAM on a biannual basis. The TAM targets will be taken through MAG's committee process for approval each year.

More information about TAM plans can be found here:
https://www.transit.dot.gov/TAM/TAMPlans

Public Transportation Agency Safety Plans (PTASP)

On December 31,2020 the first iteration of Public Transportation Agency Safety Plans (PTASP) are due to the Federal Transit Administration. The plans must include safety performance targets set by transit providers. Furthermore, the plans must be updated and certified by the providers annually thereafter. Valley Metro and the City of Phoenix are currently developing their PTASPs. Like the TAM plans, the PTASP will be taken through MAG's committee process for approval.

More information about PTASP can be found here: https://www.transit.dot.gov/PTASP

Regional Mobility & Congestion

Despite being the 11th largest metropolitan statistical area in the United States[2], Tom Tom Travel Index data lists Phoenix as the 45th most congested city in the country for 2018[3]. That puts Phoenix below places like Baton Rouge, Boise and Tucson. Nevertheless, the MAG region still suffers from congestion, particularly during the peak period. Congestion affects the movement of goods and people and has environmental impacts due to increased fuel consumption. Annually, Texas A&M University Transportation Institute, a nationwide leader in assessing the impacts of congestion, estimates that congestion costs the region $3.3 billion.

As Chart 8 shows, Arizona's population has been steadily growing along with VMT. This trend is expected to continue and will place further stress on our transportation system. This will lead to increased congestion should mitigation efforts be unable to keep pace.

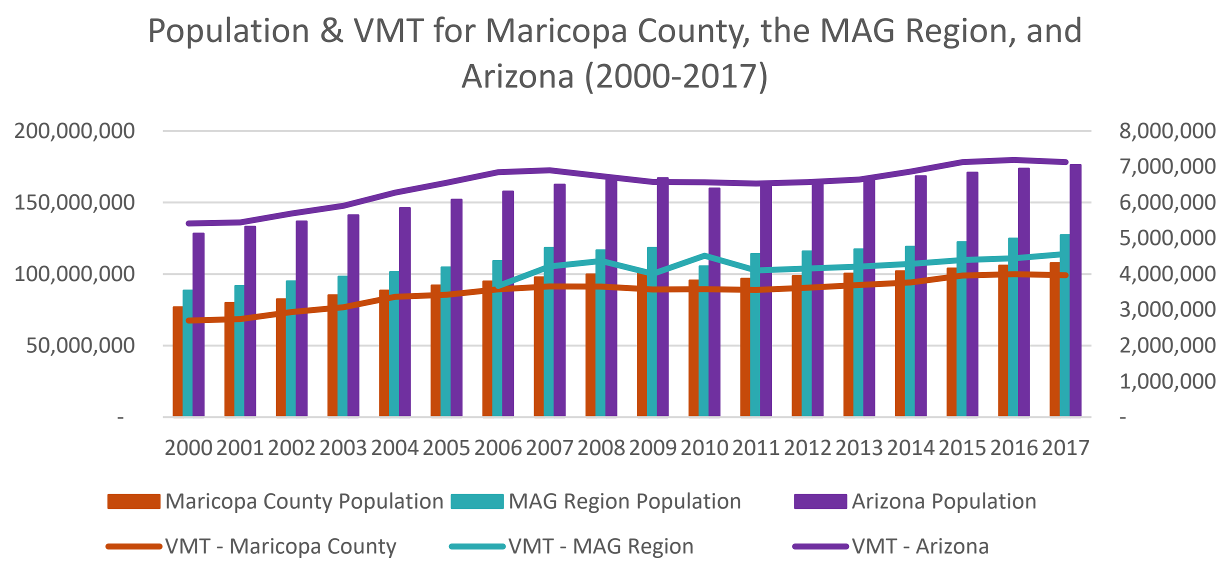


Chart 8 - Vehicle Miles Traveled & Population, 2000-2017. Source: ADOT HPMS

MAG uses several data sources to examine congestion in the region across a variety of facilities. For the purposes of performance measurement, congestion is defined as a ratio of the measured speed divided by the speed limit for each stretch of roadway in the network. The data is further broken down by time periods.

There are two types of congestion:

Recurring

Daily congestion--not related to construction, crashes or special events--is known as recurring congestion. The Texas A&M University Transportation Institute publishes an annual mobility report that attempts to quantify the costs of congestion. Per their 2017 report, congestion in the

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[2] https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
[3] https://www.tomtom.com/en_gb/traffic-index/ranking/?country=US

Phoenix area costs an auto commuter approximately $1,089 a year in excess gas consumption and 62 hours of their time[4].

Freeway Bottlenecks

Freeway congestion is mainly observed during AM peak period (6 AM – 9 AM) and during PM period (2PM - 6PM), and it could spill over to Midday (9 AM – 2 PM) and Nighttime (6 PM – 6 AM) as well, distributed across the Valley. Freeway bottlenecks are a series of congested and consecutive freeway segments which repeatedly cause significant delay to travelers. Freeway bottlenecks typically are recurring and observed at the similar locations on a particular direction day in and day out; some bottlenecks only occur during a specific peak period, and some occur during multiple peak periods. The comprehensive temporal-spatial coverage of speed data allows us to study and measure freeway bottlenecks on daily level throughout an extended time. For the year of 2020, the speed data from January and February are analyzed to measure freeway bottlenecks in the region. There are five bottlenecks are particularly congested as shown in Figure 1 below.

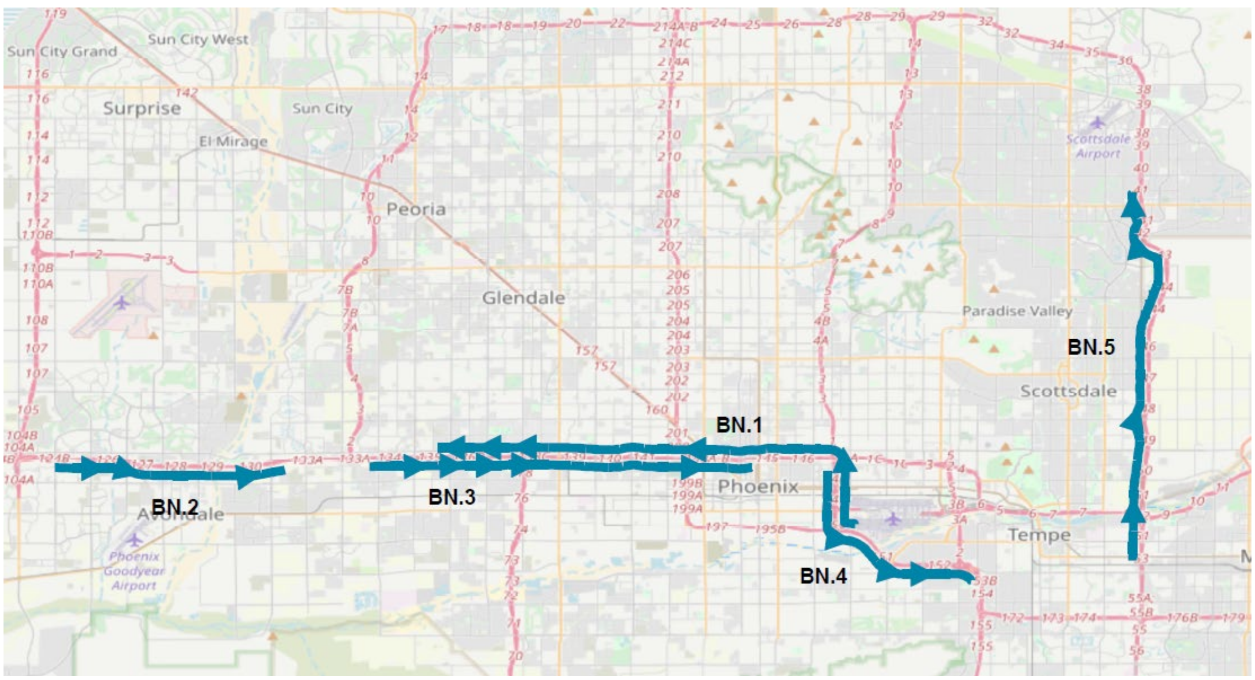


Figure 1 - Top Five Congested Freeway Bottlenecks. Source: INRIX

#1 - Westbound I-10, approximately from 24th Street to 75th Avenue.

#2 – Eastbound I-10, approximately from Sarival Avenue to Avondale Boulevard.

#3 – Eastbound I-10, approximately from 91st Avenue to 7th Street.

#4 - Eastbound I-10, approximately from Roosevelt Street to Broadway Road.

[4] https://mobility.tamu.edu/umr/congestion-data/

#5 – Southbound Loop 101, approximately from Shea Boulevard to Broadway Road.

These bottlenecks present different congestion delay characteristics as shown in the following. The chart on the left indicates bottleneck's length (color of ring, green as short and purple as long), duration (length of ring), and occurrence time (from inner ring to outer ring as from January 1st, 2020 to February 29th, 2020). The chart on the right displays bottleneck's speed profile, average speed, minimum speed, 5% speed, 95% speed and maximum speed.

Bottleneck #1 (Westbound I-10, approximately from 24th Street to 75th Avenue). The traffic congestion is mainly observed between 2 PM and 7 PM during weekdays. The average speed during the peak hour at this bottleneck is found to be 20-25 mph.

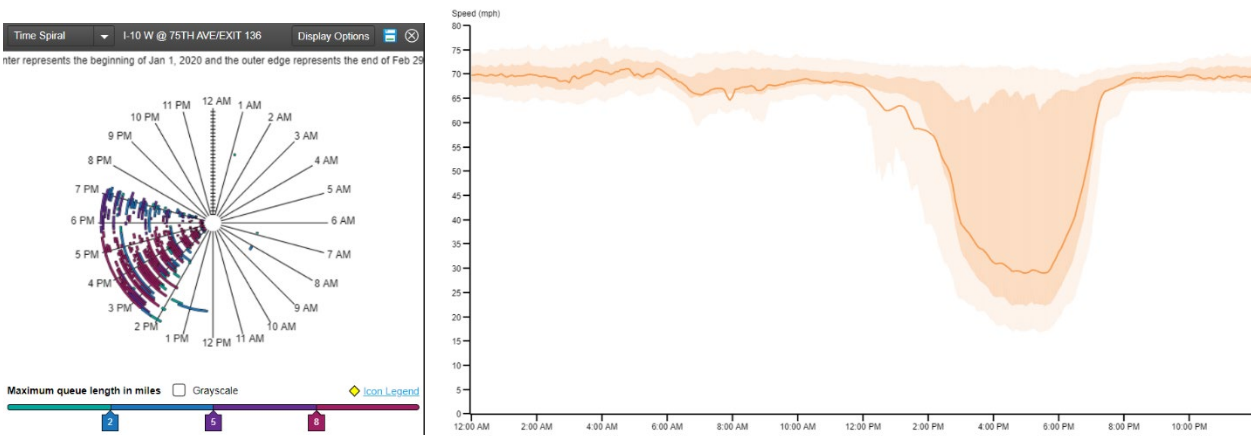


Chart 7 - Westbound I-10, approximately from 24th Street to 75th Avenue. Source: INRIX

Bottleneck #2 (Eastbound I-10, approximately from Sarival Avenue to Avondale Boulevard). This bottleneck is observed in both AM and PM during weekdays. The average speed of AM is lower than average speed of PM, while the duration of congestion during PM is longer.

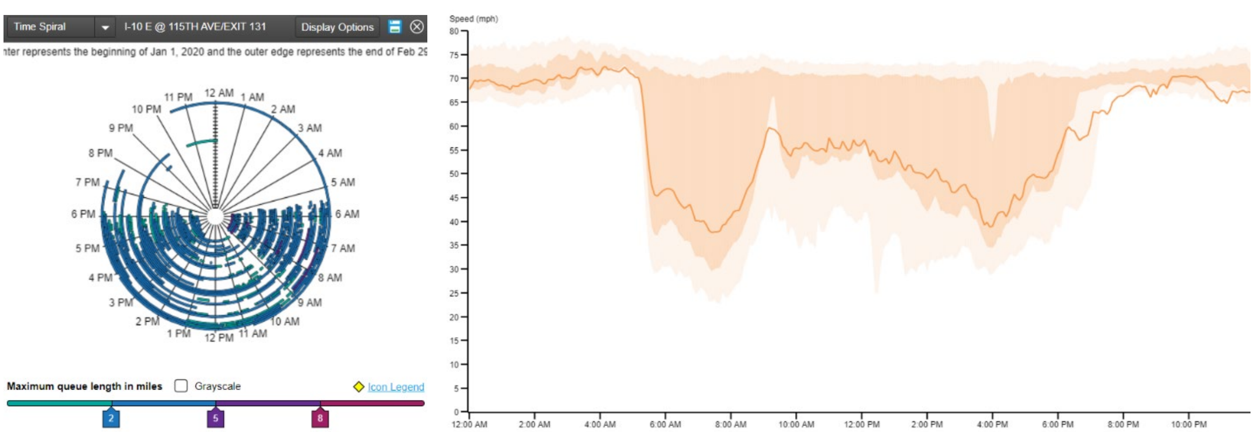


Chart 8 - Eastbound I-10, approximately from Sarival Avenue to Avondale Boulevard. Source: INRIX

Bottleneck #3 (Eastbound I-10, approximately from 91st Avenue to 7th Street). The congestion on this bottleneck mainly occurs between 5 AM and 10 AM during weekdays, and the congestion could occur in PM in some days as well. The congested speed during AM could be as low as 25 mph.

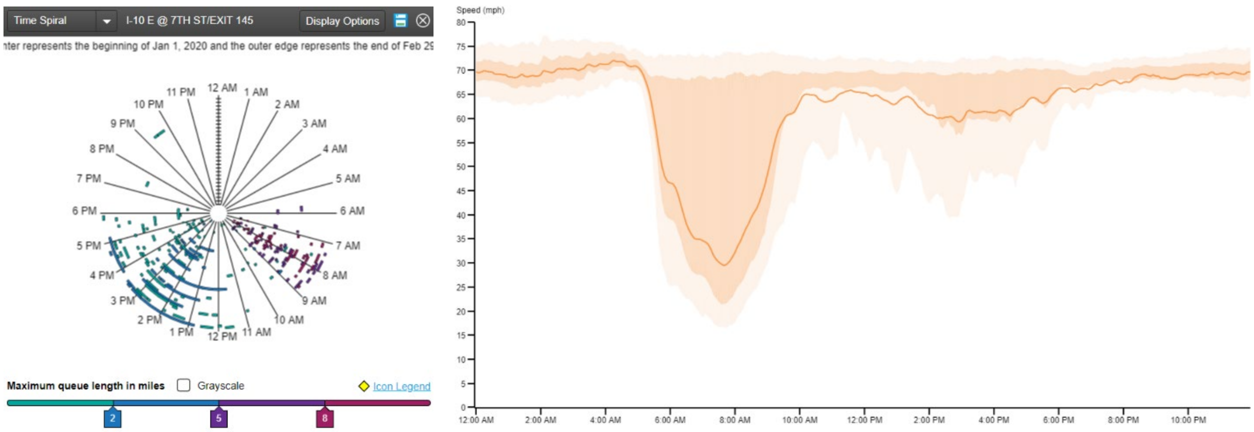


Chart 9 - Eastbound I-10, approximately from 91st Avenue to 7th Street. Source: INRIX

Bottleneck #4 (Eastbound I-10, approximately from Roosevelt Street to Broadway Road). This bottleneck is mainly observed from 2:30 PM to 6:30 PM during weekdays. The average speed during the peak hour is 35 mph.

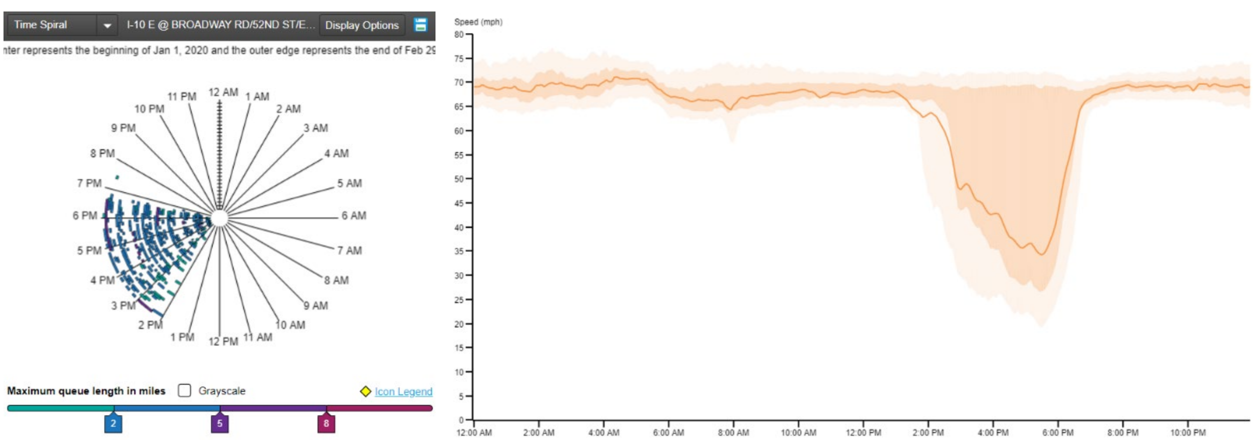


Chart 10 - Eastbound I-10, approximately from Roosevelt Street to Broadway Road. Source: INRIX

Bottleneck #5 (Southbound Loop 101, approximately from Shea Boulevard to Broadway Road). This bottleneck occurs during PM in weekdays, and the peak hour is observed from 5 PM to 6 PM with an average speed of 40 mph.

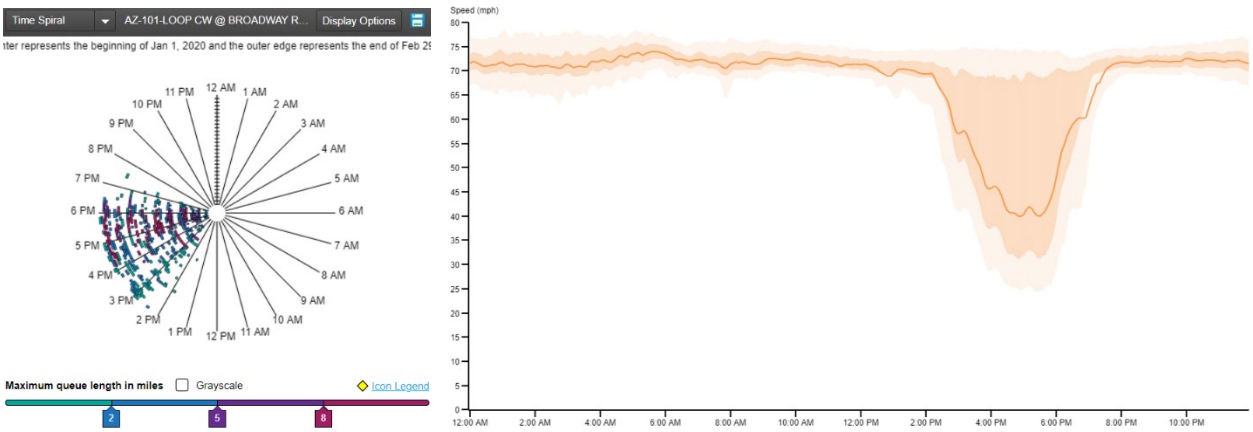


Chart 11 - Southbound Loop 101, approximately from Shea Boulevard to Broadway Road. Source: INRIX

Non-recurring

Congestion caused by construction, crashes or special events is classified as non-recurring. This type of congestion is more difficult to mitigate due to its sporadic nature. Identifying and being prepared to respond quickly to non-recurring congestion events is vital to reducing their impact.

Arizona Cardinal Football games are a good example of non-recurring congestion. To highlight this, we have analyzed INRIX data using the Probe Data Analytics Suite to highlight the impact a game has on our system. On Thursday, October 18, 2018, the Arizona Cardinals played the Denver Broncos at State Farm Stadium in Glendale. The stadium is served by the Loop 101 (Agua Fria Freeway) and local arterials with significant event-specific traffic management. Kickoff was at 5:20 PM Arizona Time.

To provide a more complete picture, we have selected three days for analysis:

- Thursday, October 11, 2018.
- Thursday, October 18, 2018 – game day.
- Thursday, November 1, 2018.[5]

To appropriately analyze the impact of the Cardinals game, four segments were analyzed separately. The four segments are:

- Going to the stadium – Northbound Loop101 from Indian School Road to Glendale Avenue.

[5] Thursday, October 25, 2018, was dropped from consideration due to a crash resulting in skewed speed results.

- Going to the stadium – Southbound Loop 101 from Olive Avenue to Glendale Avenue.
- Leaving the stadium – Northbound Loop 101 from Glendale Avenue to Olive Avenue.
- Leaving the stadium – Southbound Loop 101 from Glendale Avenue to Indian School Road.

Before the Game

As shown in Chart 16, there is an early and pronounced reduction in speed on game day ending approximately around kickoff.

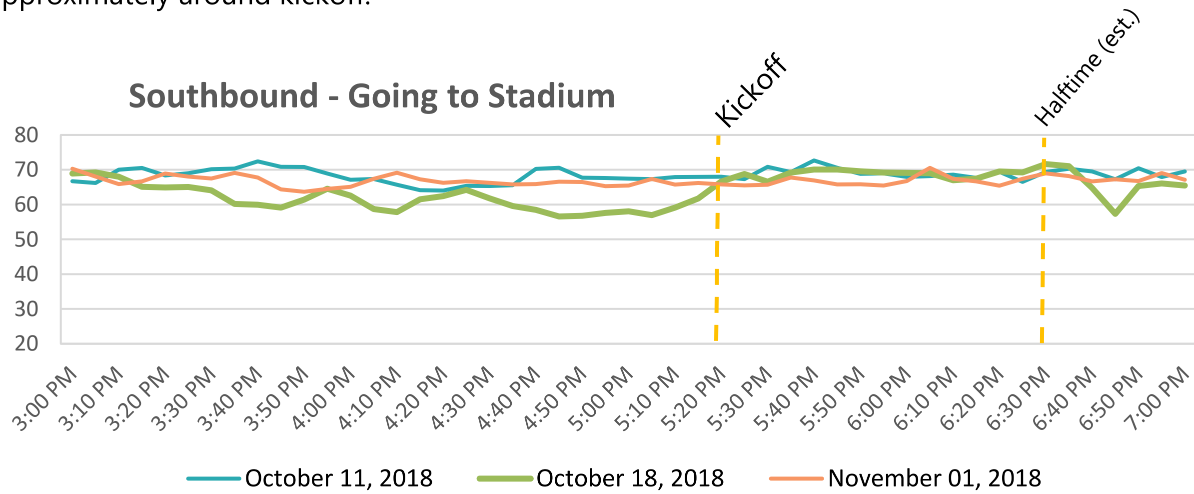


Chart 14 - Southbound to State Farm Field, selected dates 2018. Source: INRIX

Heading northbound, we see a more pronounced dip in speeds just prior to kickoff.

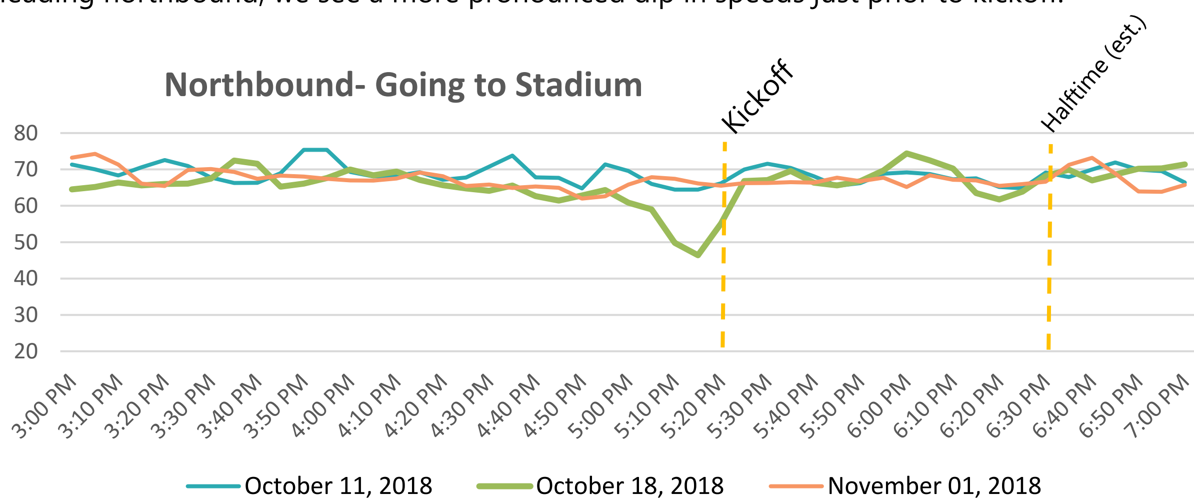


Chart 15 - Northbound to State Farm Field, selected dates 2018. Source: INRIX

After the Game

While performing the analysis for this section, a noticeable decrease in speed was discovered that coincides with halftime of the football game. It should be noted that for this particular contest, the Cardinals were down 35-3 at the half.

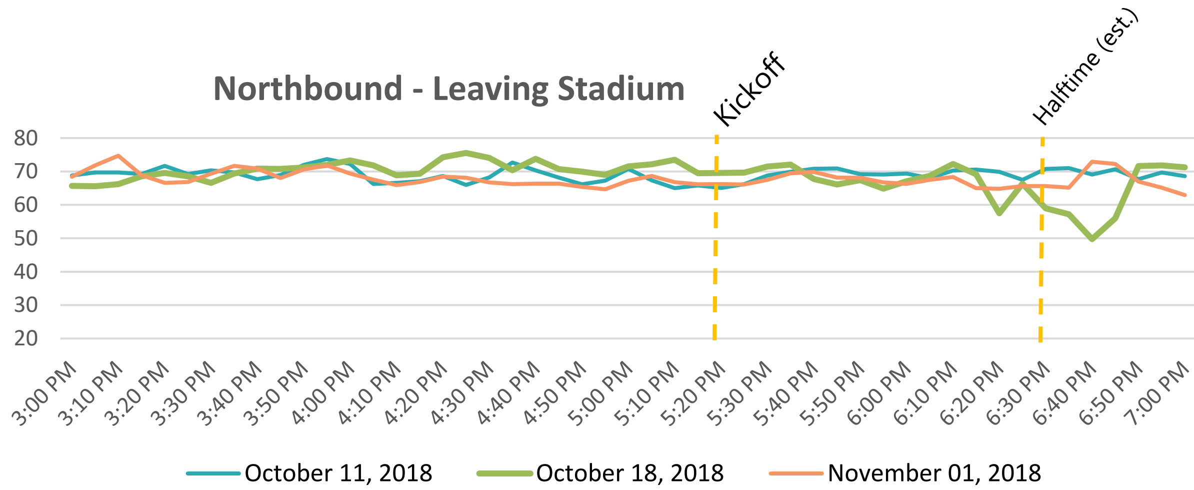


Chart 16 - Northbound leaving State Farm Field, selected dates 2018. Source: INRIX

The game concluded at approximately 8:30 PM that evening. As you can see in Chart 17, a sizable decrease in speed is found on the southbound Loop 101 following the conclusion of the game. A similar decrease in speed was not noted heading northbound away from the stadium.

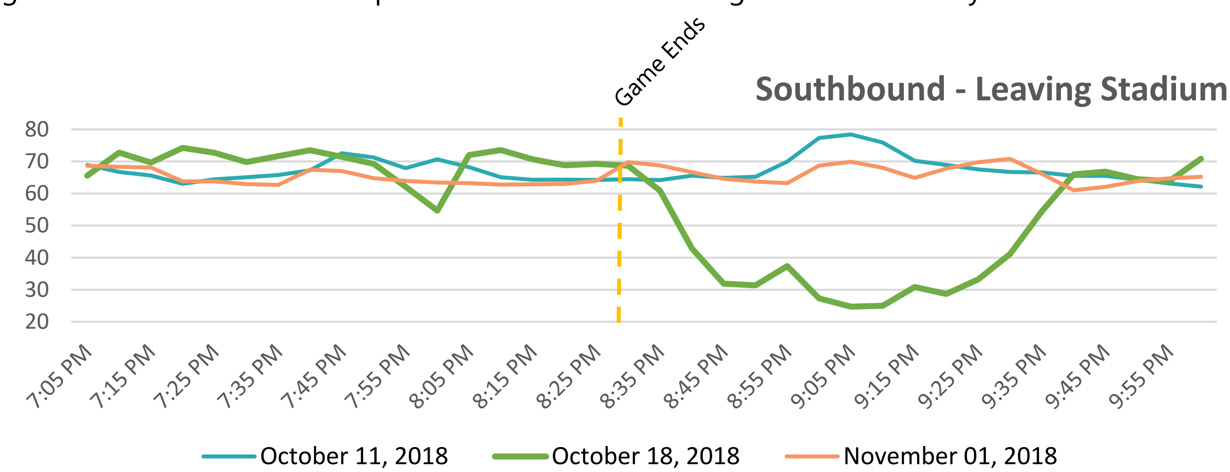


Chart 17 - Southbound leaving State Farm Field, selected dates 2018. Source: INRIX

The MAG region hosts hundreds of large-scale events each year. This analysis highlights just one of those events.

Transit System Performance

Valley Metro annually publishes a report on the performance of their transit system. It includes fixed-route bus, light rail, paratransit and vanpool. Their annual report going back to 2007 can be found here: https://www.valleymetro.org/transit-performance-reports

Bottlenecks

While congestion arises from an overloaded system unable to keep up with current demand, bottlenecks are the result of specific design or design elements of a roadways system. This can include the design of the roadway itself, poorly timed signals, inconsistent lane widths, the presence of a breakdown lane and numerous other potential factors. The example most people are familiar with is the abrupt ending of a traffic lane causing vehicles to immediately need to merge.

Another example of a structural bottleneck is weaving. When vehicles are forced to cross multiple lanes of traffic to get to their preferred route, they slow traffic for the entire area. One of the best examples of this is the I-10 Broadway Curve, shown in Figure 2.

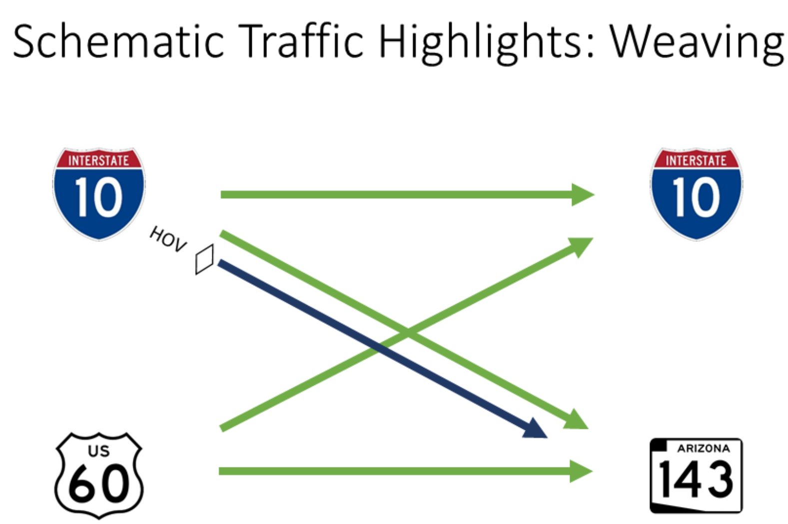


Figure 2 – Weaving at I-10 Broadway Curve

Imagine a roadway user traveling westbound on I-10 who would eventually like to end up on SR 143. When they pass the junction with the US 60, the three westbound lanes suddenly become six westbound lanes and they have a little more than a mile to get into the right lane. Trying to cross those couple of lanes while roadways users from US 60 are attempting to move into the left lanes causes an observable slow down during peak periods. This is a classic example of a structural bottleneck due to weaving.

Bottlenecks can also be dynamic. An example of a dynamic bottleneck is semi-truck or towing vehicle that cannot keep up with the speed of traffic resulting in a build-up of traffic behind the vehicle. These dynamic bottlenecks are extremely difficult to identify without visual confirmation of the cause of the bottleneck.

Corridor-Level Performance

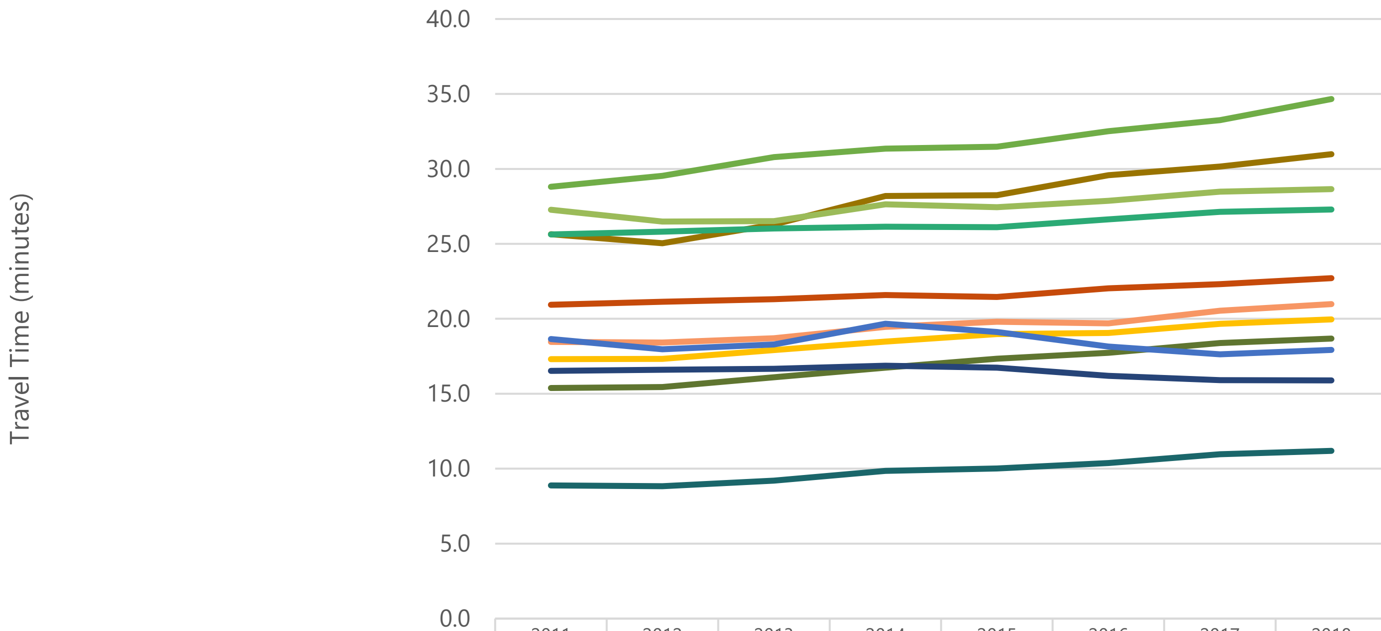
In an effort to provide succinct information about traveling across the region, a collection of corridors representing major commuting routes have been identified. In the sections below, performance of each corridor is represented with a chart reflecting the travel time by year. As summarized in Table 3 and shown in Table 4, travel times in nearly all corridors have been increasing steadily.

The only exception is corridor number eight along the Loop 101 from the US 60 to Frank Lloyd Wright Boulevard. Discussed in the Project Spotlights section of this report, approximately $100.2 million was allocated to increase the capacity of the Loop 101 facility leading to the improved travel times.

#	Commute Corridor	Change in Travel Time 2011-2018 (minutes)
1	I-10 to Loop 202 (Red Mountain): Eastbound - AM I-10 at 83rd Ave to Loop 202 (Red Mountain) at Loop 101	05:19
1	I-10 to Loop 202 (Red Mountain): Eastbound - PM I-10 at 83rd Ave to Loop 202 (Red Mountain) at Loop 101	01:46
2	SR 143 to I-10 to US 60: Eastbound - PM SR 143 at Sky Harbor Blvd to US 60 at Val Vista Dr.	02:31
3	I-10 to US 60: Eastbound - PM I-10 at 7th St to US 60 at Loop 101	02:39
4	Loop 101 (Price) to US 60 to I-10 to I-17: Westbound/Northbound - AM Loop 101 (Price) at Guadalupe Rd to I-17 at Dunlap Ave	01:22
4	Loop 101 (Price) to US 60 to I-10 to I-17: Westbound/Northbound - PM Loop 101 (Price) at Guadalupe Rd to I-17 at Dunlap Ave	05:51
5	I-17 to I-10: Eastbound - PM I-17 at 19th Ave to I-10 at Elliot Rd	03:17
6	SR 143 to I-10: Southbound - PM SR 143 at University Blvd to I-10 at Warner Rd	02:00
7	I-10 to SR 51: Eastbound/Northbound - PM I-10 at 83rd Ave to SR 51 at Bell Rd	01:39
8	Loop 101: Northbound - AM Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd	-00:43
8	Loop 101: Northbound - PM Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd	-00:37

Table 3 - Change in Travel Time along Selected Commute Corridors 2011-2018. Source: HERE

Travel Times Along Selected Commute Corridors

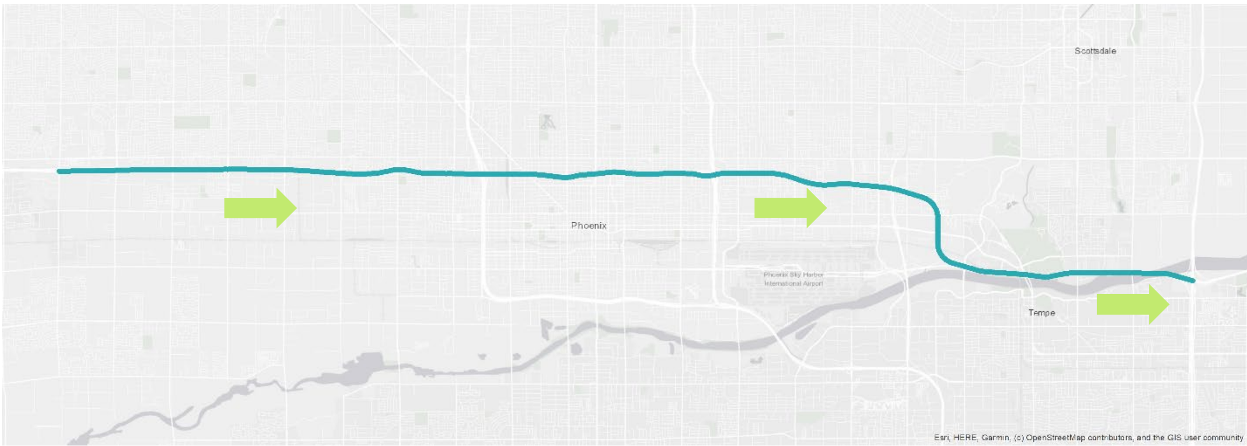


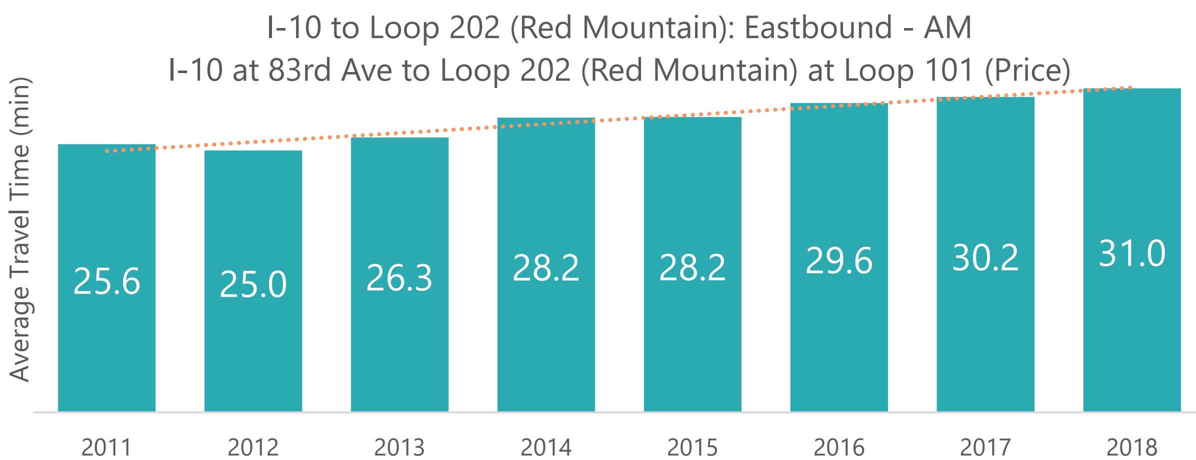
	2011	2012	2013	2014	2015	2016	2017	2018
I-10 to Loop 202 (Red Mountain): Eastbound - AM I-10 at 83rd Ave to Loop 202 (Red Mountain) at Loop 101 (Price)	25.6	25.0	26.3	28.2	28.2	29.6	30.2	31.0
I-10 to Loop 202 (Red Mountain): Eastbound - PM I-10 at 83rd Ave to Loop 202 (Red Mountain) at Loop 101 (Price)	20.9	21.1	21.3	21.6	21.5	22.0	22.3	22.7
SR 143 to I-10 to US 60: Eastbound - PM SR 143 at Sky Harbor Blvd to US 60 at Val Vista Dr	18.5	18.4	18.7	19.5	19.8	19.7	20.5	21.0
I-10 to US 60: Eastbound - PM I-10 at 7th St to US 60 at Loop 101 (Price)	17.3	17.3	17.9	18.5	19.0	19.1	19.7	20.0
Loop 101 (Price) to US 60 to I-10 to I-17: Westbound/Northbound - AM Loop 101 (Price) at Guadalupe Rd to I-17 at Dunlap Ave	27.3	26.5	26.5	27.6	27.4	27.9	28.5	28.7
Loop 101 (Price) to US 60 to I-10 to I-17: Westbound/Northbound - PM Loop 101 (Price) at Guadalupe Rd to I-17 at Dunlap Ave	28.8	29.5	30.8	31.4	31.5	32.5	33.3	34.7
I-17 to I-10: Southbound - PM I-17 at 19th Ave to I-10 at Elliot Rd	15.4	15.4	16.1	16.7	17.3	17.7	18.4	18.7
I-10 to SR 51: Eastbound/Northbound - PM I-10 at 83rd Ave to SR 51 at Bell Rd	25.6	25.8	26.0	26.1	26.1	26.6	27.1	27.3
SR 143 to I-10: Southbound - PM SR 143 at University Blvd to I-10 at Warner Rd	8.9	8.8	9.2	9.9	10.0	10.4	11.0	11.2
Loop 101: Northbound - AM Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd	18.6	18.0	18.3	19.7	19.1	18.2	17.6	17.9
Loop 101: Northbound - PM Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd	16.5	16.6	16.7	16.9	16.7	16.2	15.9	15.9

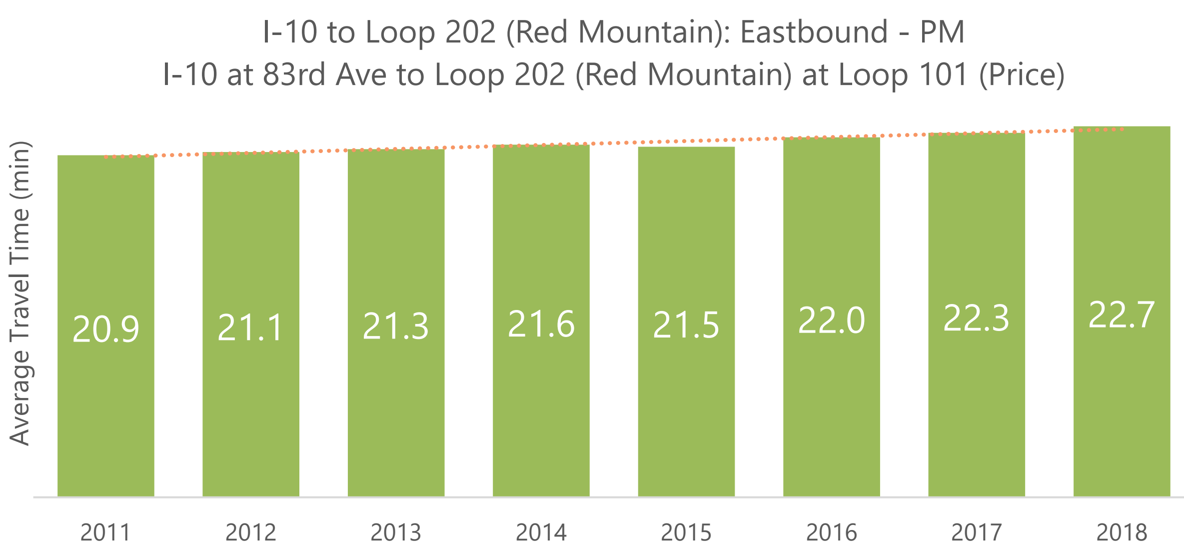
Table 4 - Travel Times Along Selected Commute Corridors, 2011-2018. Source: HERE

Corridor 1

I-10 to Loop 202 (Red Mountain): I-10 at 83rd Avenue to Loop 202 (Red Mountain) at Loop 101

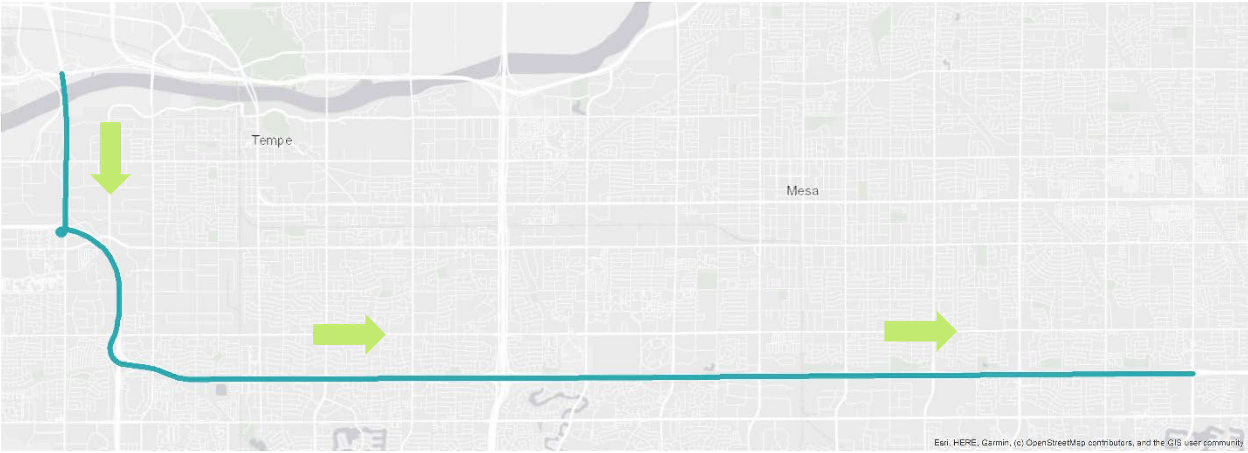


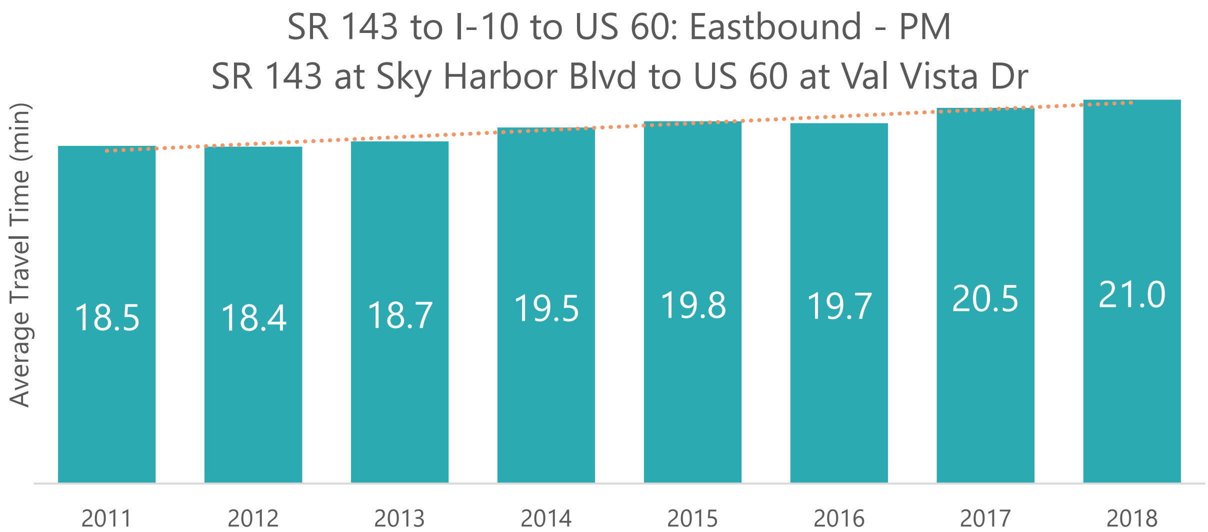




Corridor 2

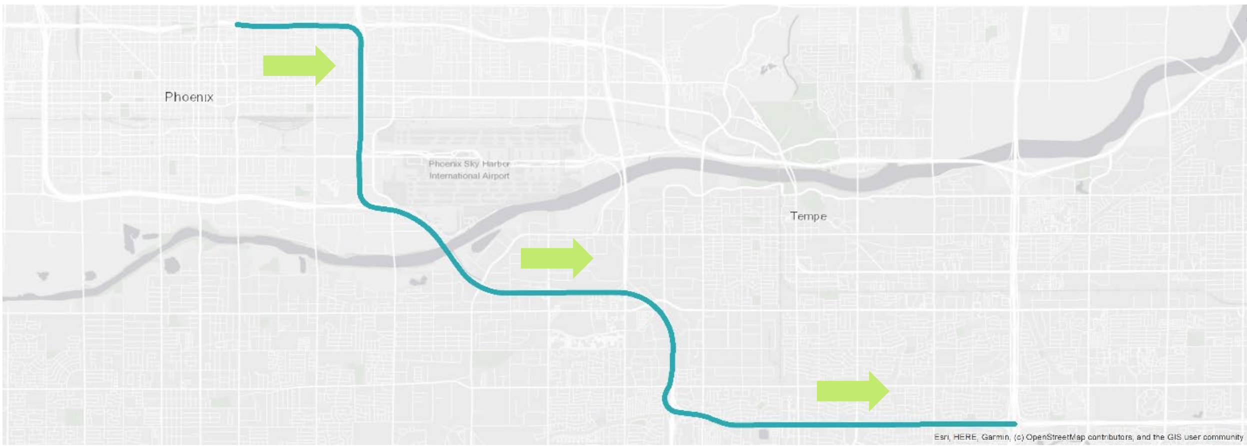
SR 143 to US 60: SR 143 at Sky Harbor Boulevard to US 60 at Val Vista Drive

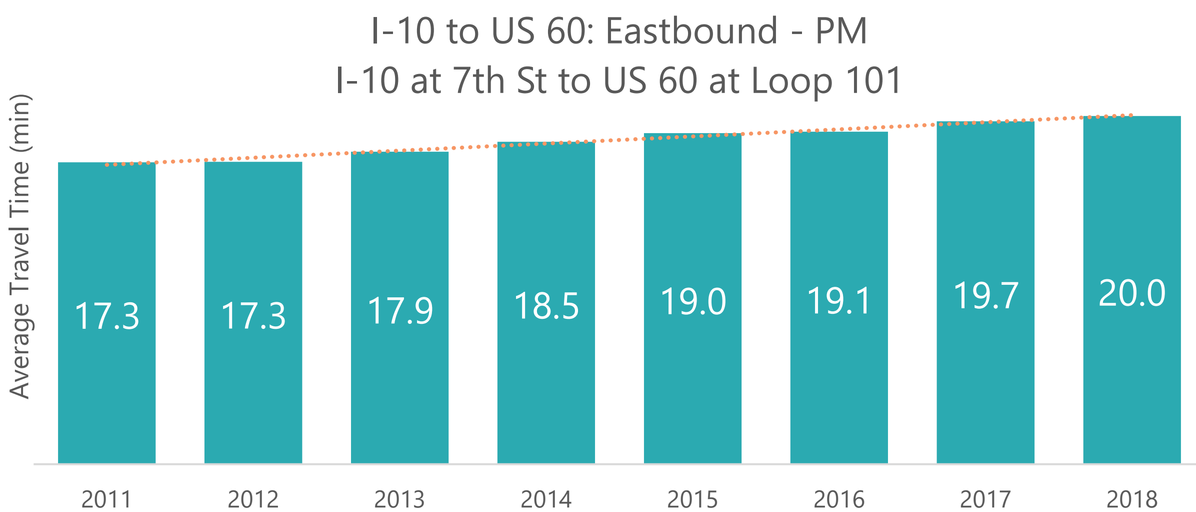




Corridor 3

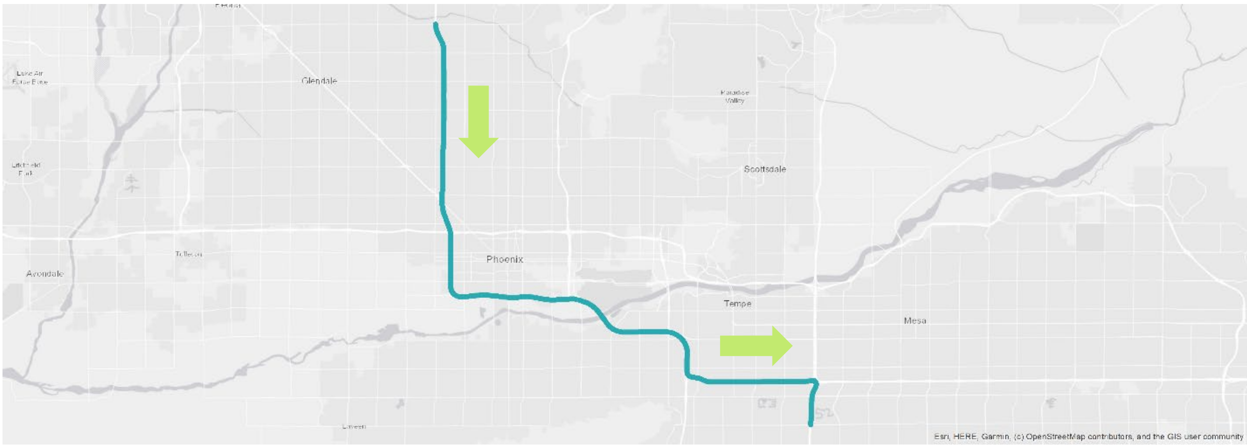
I-10 to US 60: I-10 at 7th Street to US 60 at Loop 101 (Price)

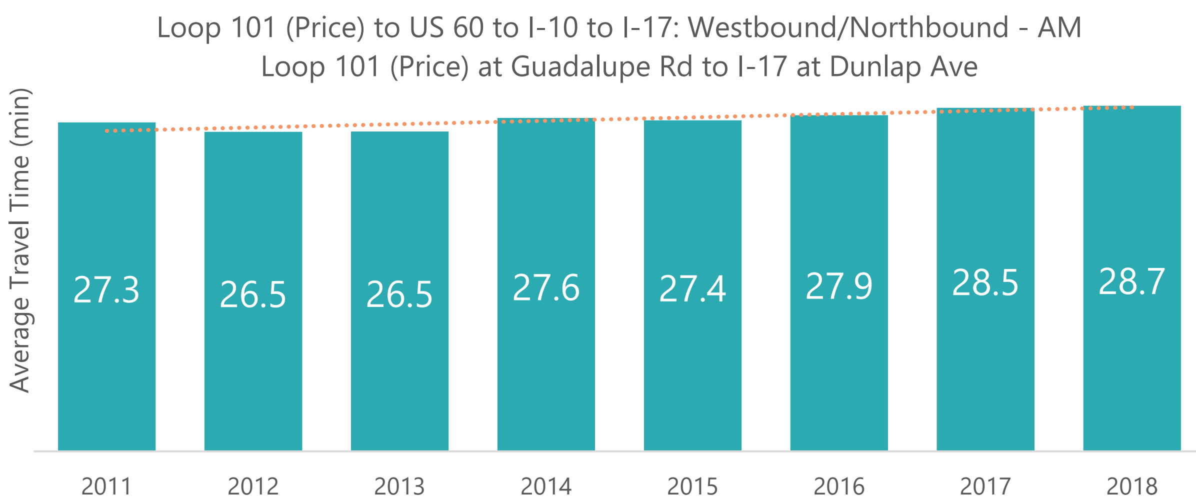


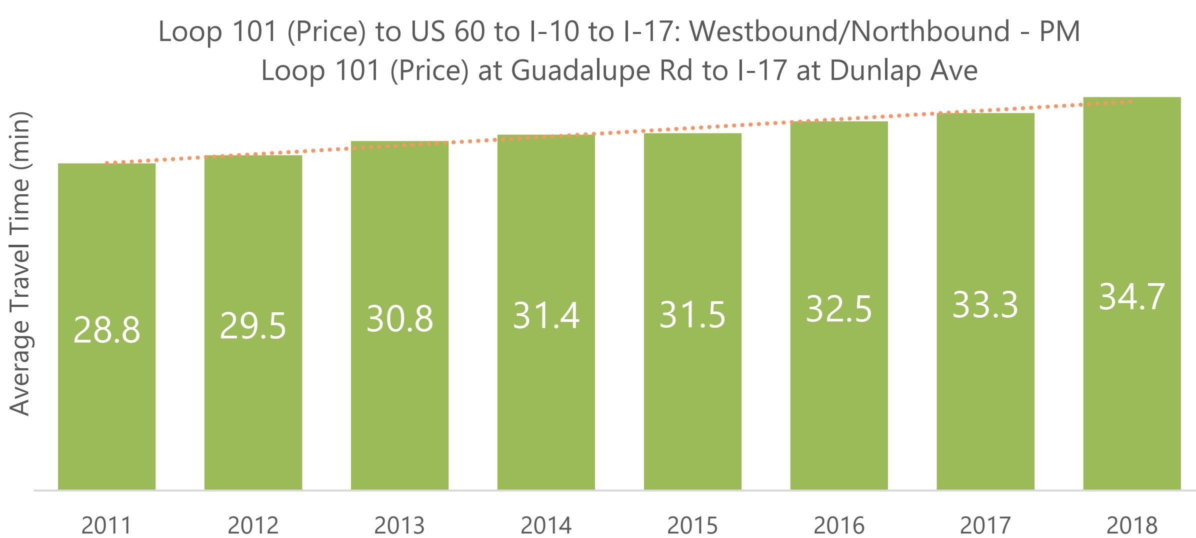


Corridor 4

Loop 101 (Price) to I-17: Loop 101 (Price) at Guadalupe Road to I-17 at Dunlap Avenue

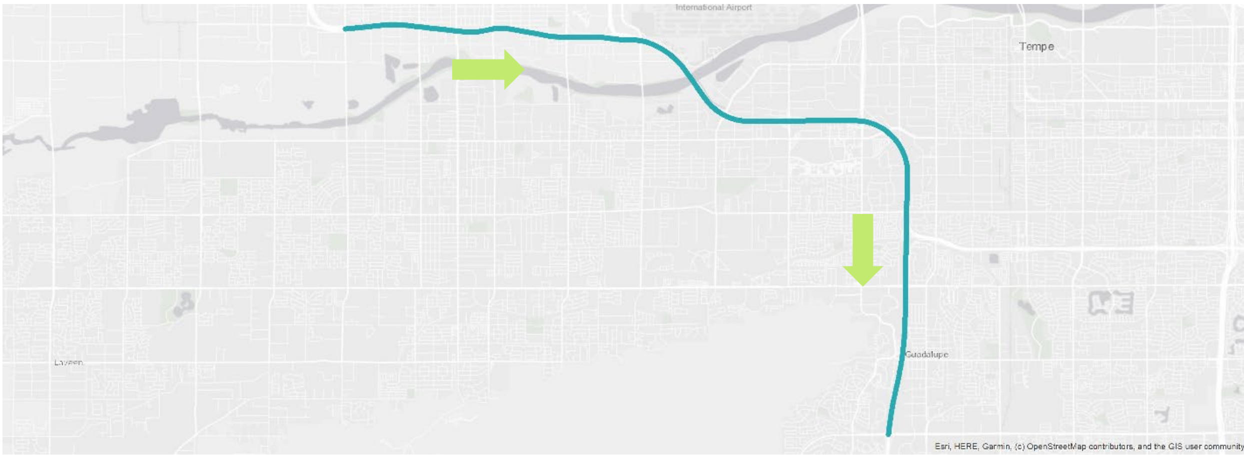


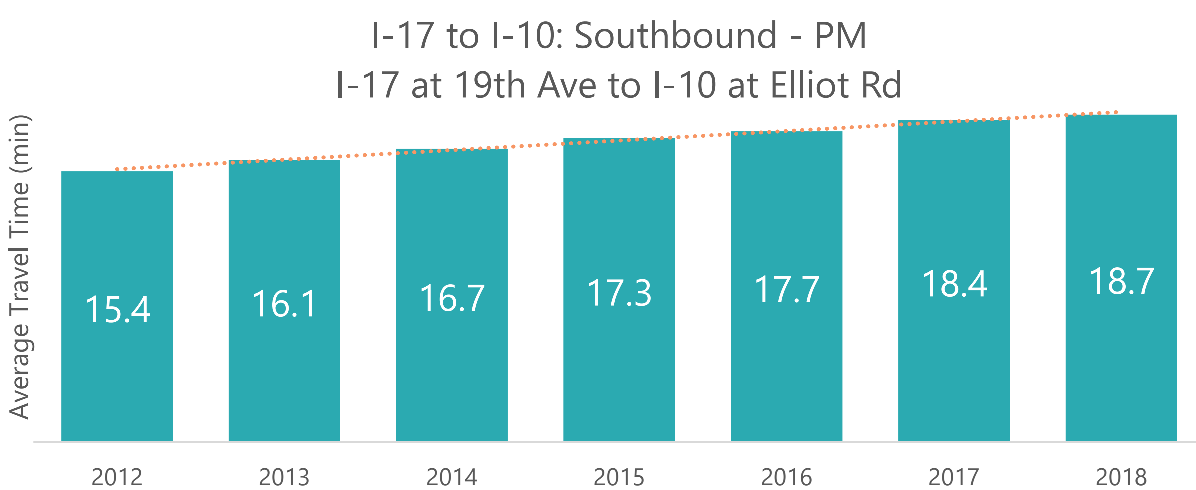




Corridor 5

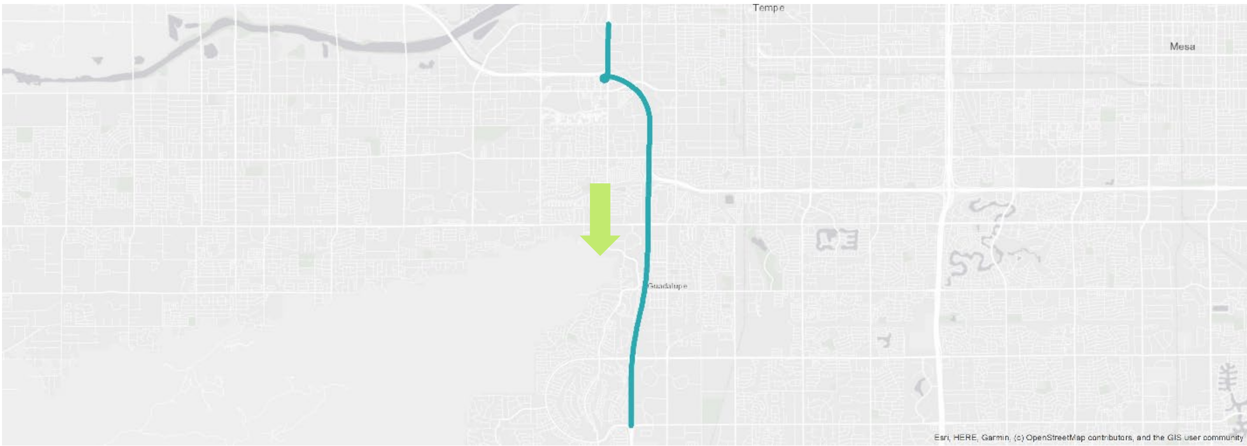
I-17 to I-10: I-17 at 19th Avenue to I-10 at Elliot Road

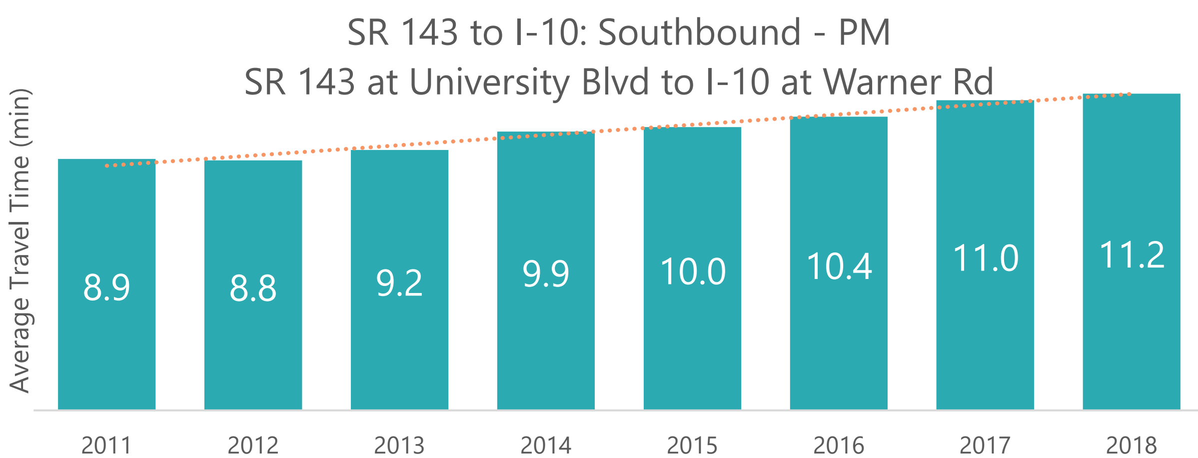




Corridor 6

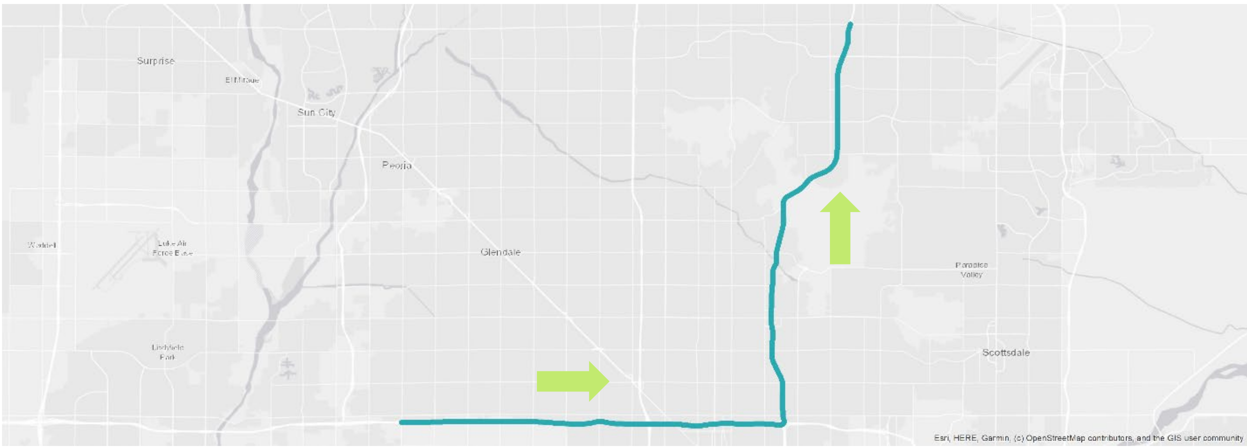
SR 143 to I-10: SR 143 at University Boulevard to I-10 at Warner Road

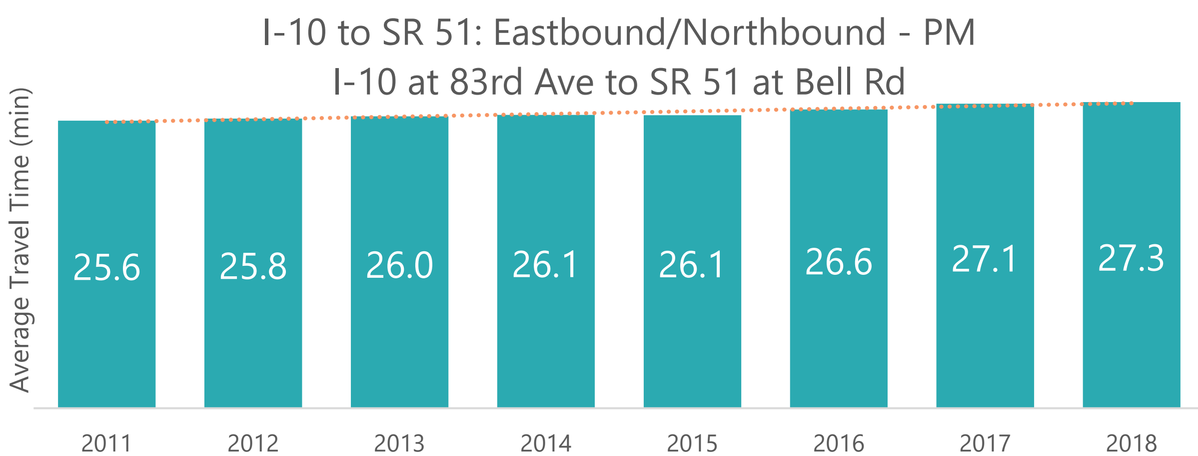




Corridor 7

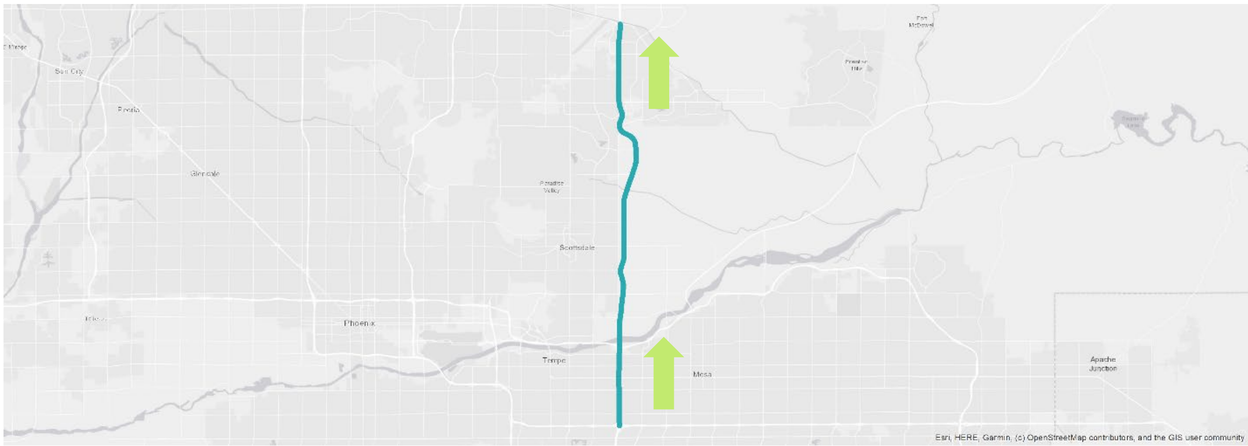
I-10 to SR 51: I-10 at 83rd Avenue to SR 51 at Bell Road



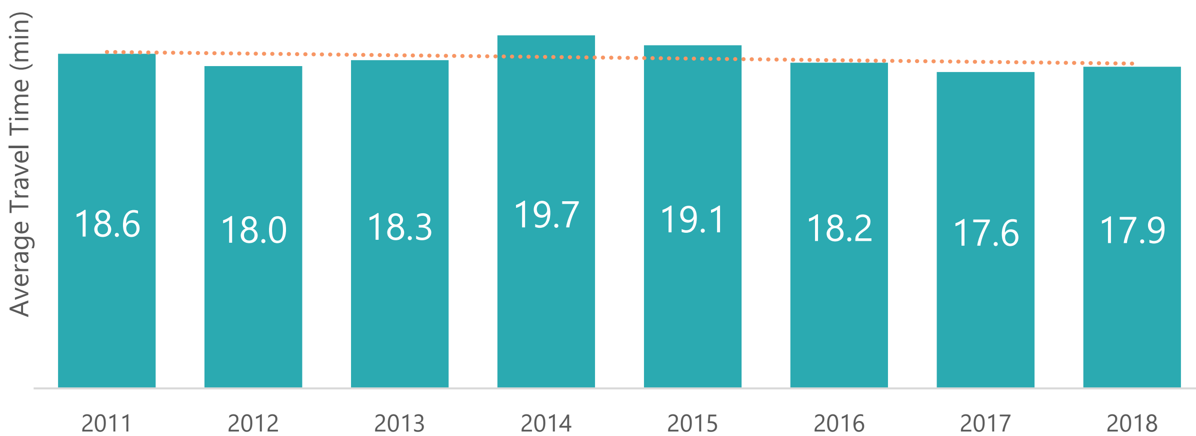


Corridor 8

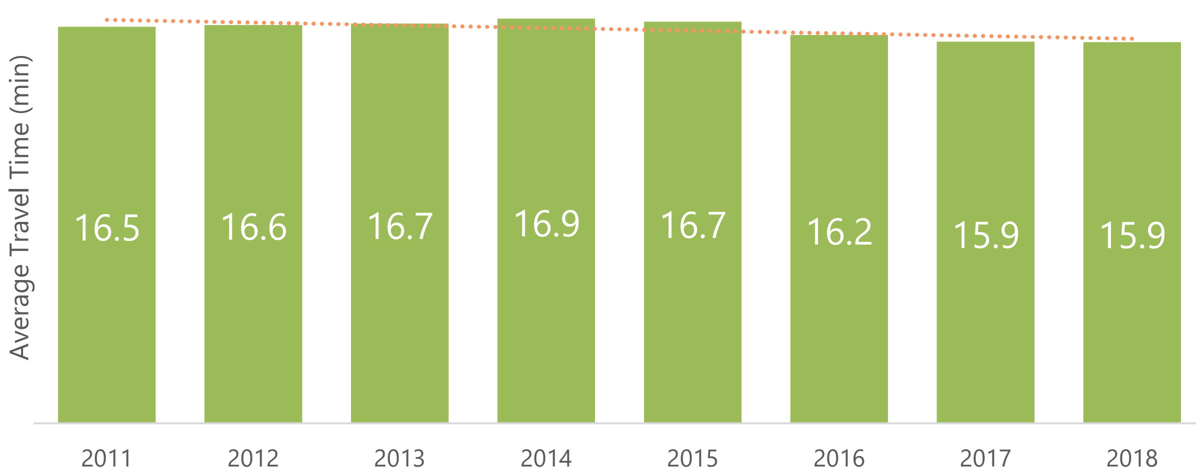
Loop 101: Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Boulevard



Loop 101: Northbound - AM
Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd



Loop 101: Northbound - PM
Loop 101 (Price) at US 60 to Loop 101 (Pima) at Frank Lloyd Wright Blvd



Non-motorized Performance

While MAG strives to evaluate performance on all modes of transportation, there is currently a lack of data available to meaningfully report about non-motorized modes beyond the growth of infrastructure.

Project Spotlights

Freeway – Loop 101 (Pima): Shea Boulevard to Loop 202 (Red Mountain)

In August of 2014, ADOT began a major expansion project on the Loop 101 (Pima Freeway). Eleven miles of freeway from Shea Boulevard to the Loop 202 (Red Mountain Freeway) were widened to include an additional general-purpose lane at a cost of approximately $100.2 million. The project also included additional merge lanes at the interchanges of Indian Bend Road and McDonald Drive, new lighting and signage, new landscaping, a new layer of rubberized asphalt, and realigned on- and off-ramps.

It was anticipated that this project would improve traffic flow and relieve some congestion through the busy Pima Freeway corridor. Peripheral construction activities also hoped to improve visibility and improve merging. Construction took approximately 28 months and was funded through Proposition 400, a half-cent sales tax voted for by the residents of Maricopa County in 2004.

To provide a consistent and data-driven analysis of the impact of this project, data from 2013 is used as “before” and 2018 data is used as the “after”. These years were selected due to the period of construction and the availability of data. Although construction on the project was finished in late 2016, traffic patterns often need time to normalize as users of the roadway find an equilibrium with their previous routines and the changed roadway conditions.

Traffic Volumes

Daily traffic volumes on this segment of the Loop 101 (Pima Freeway) have been steadily climbing. Chart 20 shows the consistent volumes on the facility. The green color below denotes the years the facility was under construction.

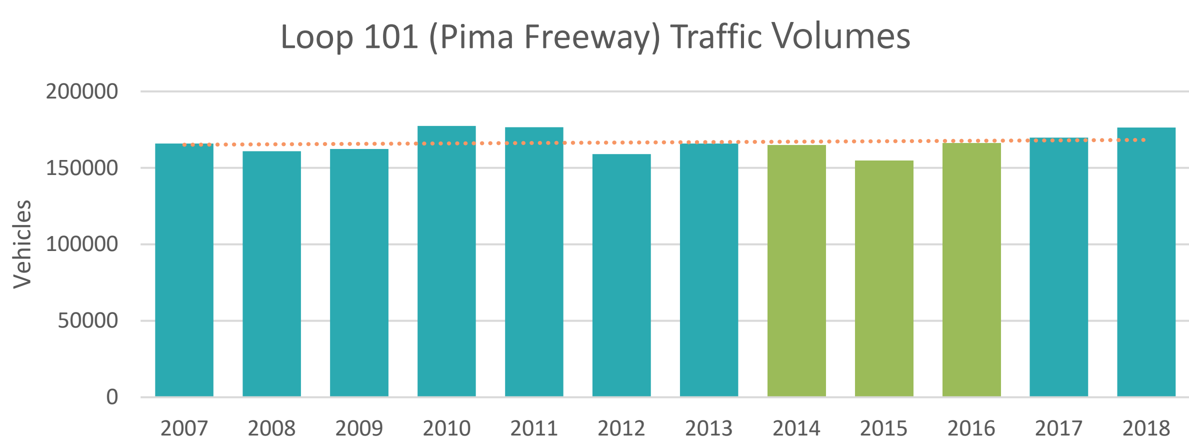


Chart 18 - Loop 101 (Pima Freeway) Traffic Volumes 2007-2018. Source: MS2

Although there is some variation in the number of facility users, analysis shows approximately 10,000 additional users.

Speed

Third party data sources confirm that weekday speeds have increased in both directions following completion of this project during all months of the year. Years 2014, 2015, and 2016 are omitted from the following tables as the facility was under active construction in those years.

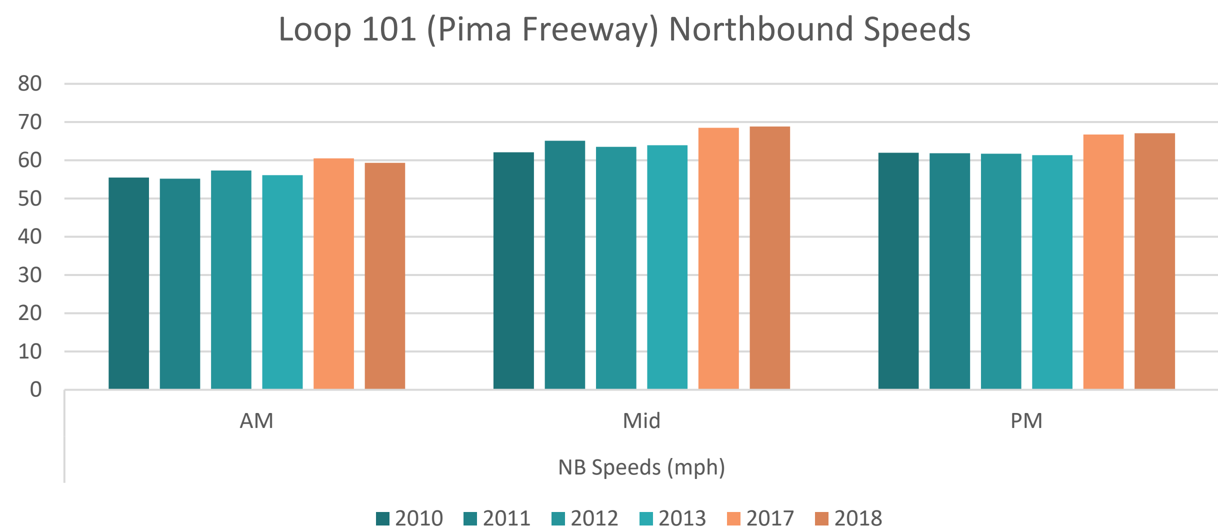


Chart 19 - Loop 101 (Pima Freeway) Northbound Speeds 2010-2013, 2017-2018. Source: HERE

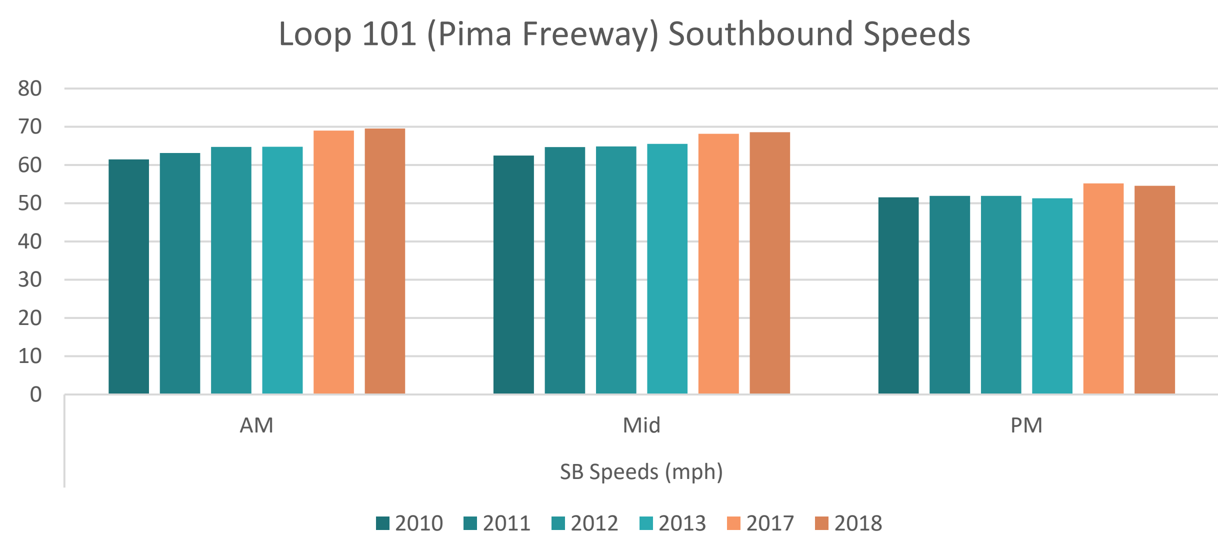


Chart 20 - Loop 101 (Pima Freeway) Southbound Speeds 2010-2013, 2017-2018. Source: HERE

One particularly meaningful aspect of this analysis is the comparison between speed, averaged from AM, midday and PM peak speeds in each direction, and volume for 2010 and 2018 shown in Table 5.

	2010	2018
Volume (AADT)	177,460	176,368
Speed (MPH)	59.2	64.7

Table 5 - Loop 101 (Pima Freeway) Speed and Volume Comparison, 2010 to 2018. Source: HERE

While both years have roughly the same volume, the speed at which the vehicles are moving in 2018 has increased more than nine percent.

Travel Time

Travel time is a measure of how long it takes a single vehicle to travel from one end of the corridor to the other. As one would expect, vehicles traveling at a higher rate of speed are taking less time to traverse the corridor. Both northbound and southbound travel times fell across all time periods.

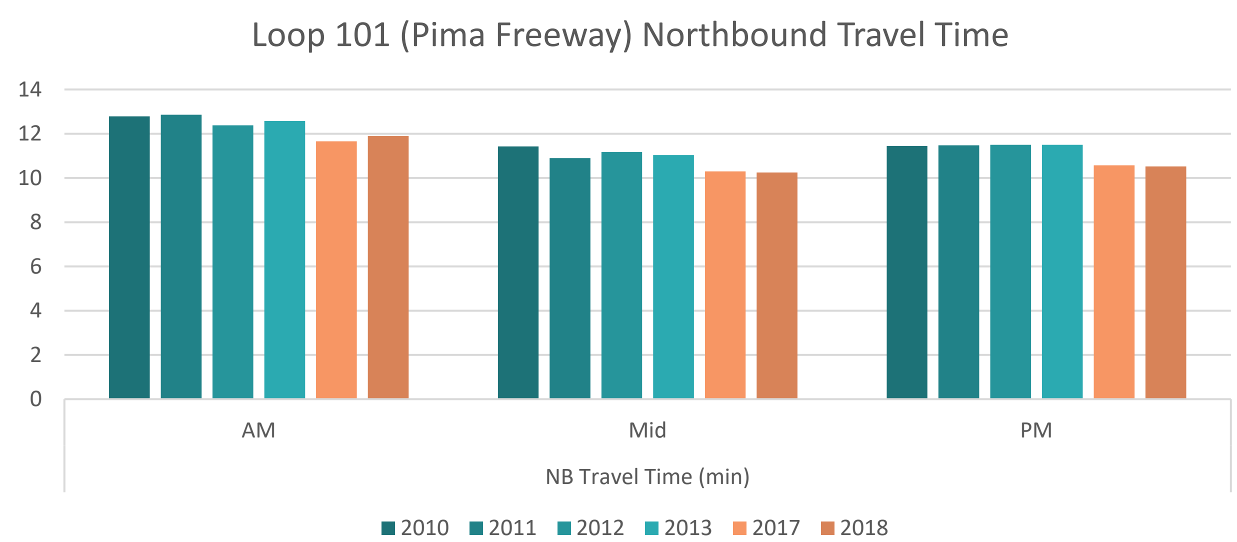


Chart 21 - Loop 101 (Pima Freeway) Northbound Travel Times 2010-2013, 2017-2018. Source: HERE

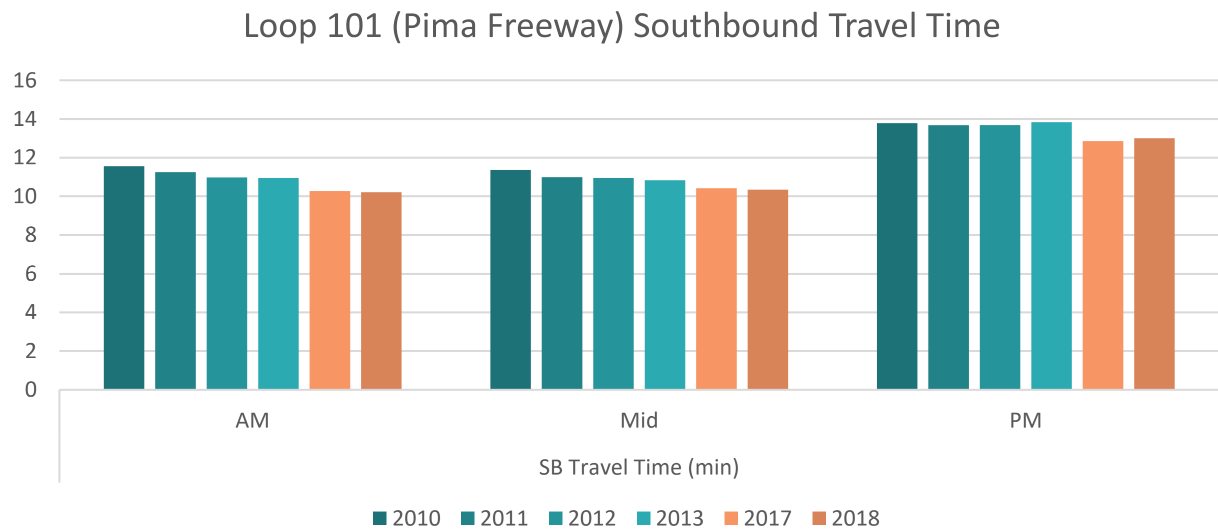


Chart 12 - Loop 101 (Pima Freeway) Northbound Travel Times 2010-2013, 2017-2018. Source: HERE

As the improved roadway attracts additional users, we would expect to see volumes increase proportionally to a decrease in travel time.

Reliability Measures

MAG uses two metrics to measure reliability: Travel Time Index (TTI) and Planning Time Index (PTI). TTI is the ratio of the travel time during the peak period to the time required to make the same trip at free-flow speeds. PTI is a ratio of the 95th percent peak period travel time to the free-flow travel time. For TTI and PTI, a larger number represents longer commutes and more travel time variability, respectively. For the Loop 101 project, both PTI and TTI improved (decreased) for all time periods indicating that the facility is now more resilient to congestion and unexpected delays. TTI is presented back to 2010 but due data availability, PTI is only available back to 2012.

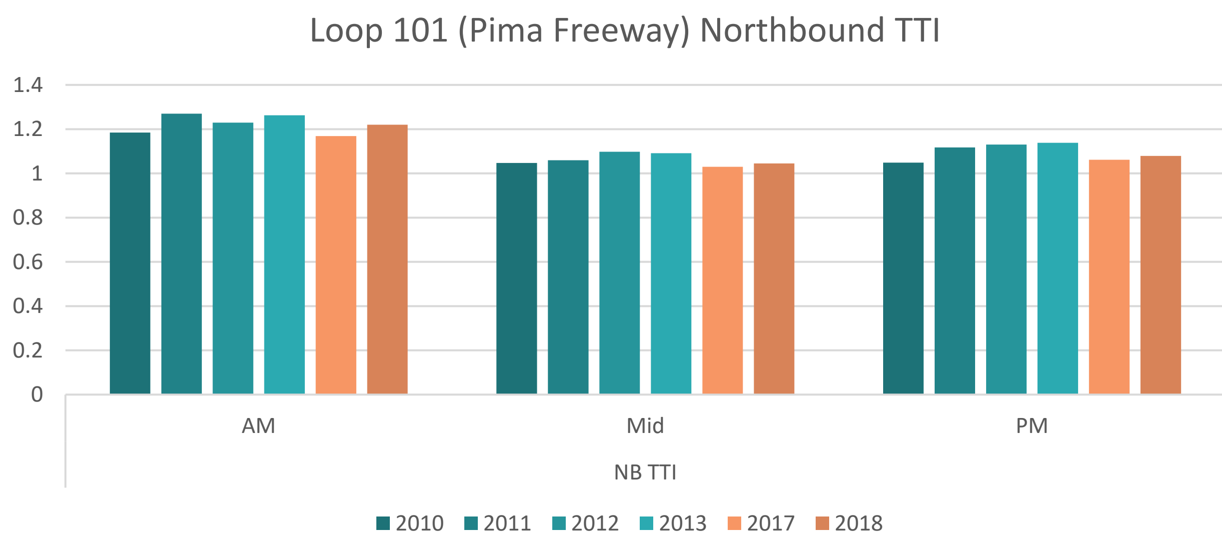


Chart 23 - Loop 101 (Pima Freeway) Northbound TTI 2010-2013, 2017-2018. Source: HERE

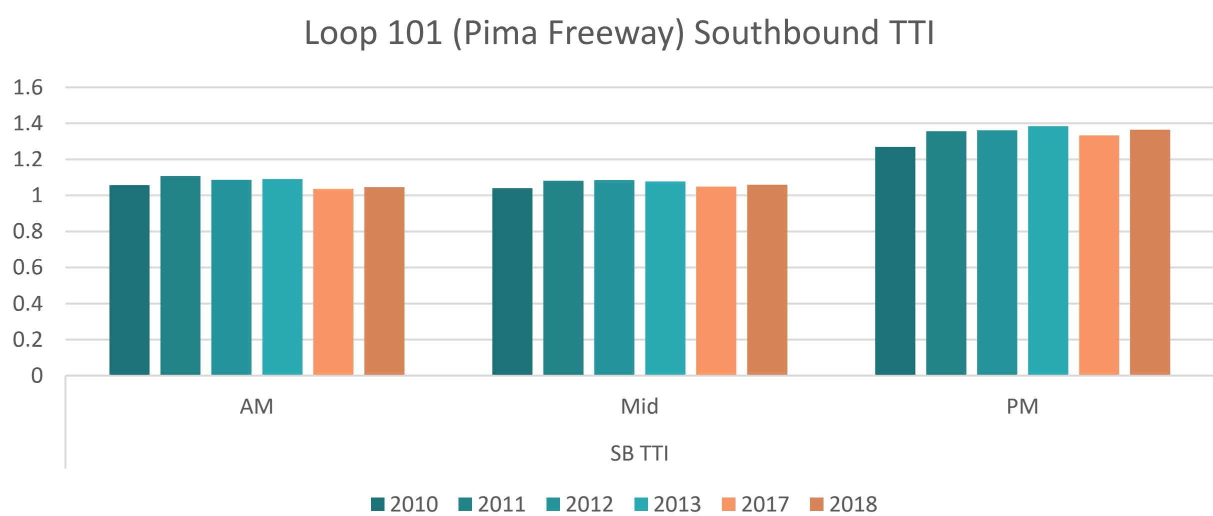


Chart 24 - Loop 101 (Pima Freeway) Southbound TTI 2010-2013, 2017-2018. Source: HERE

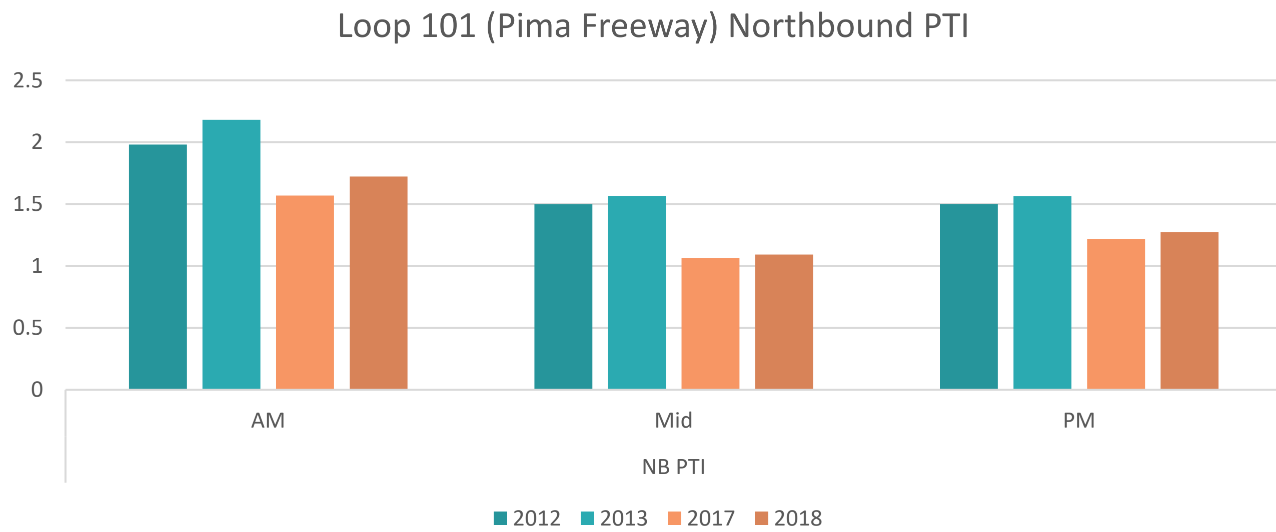


Chart 25 - Loop 101 (Pima Freeway) Northbound PTI 2010-2013, 2017-2018. Source: HERE

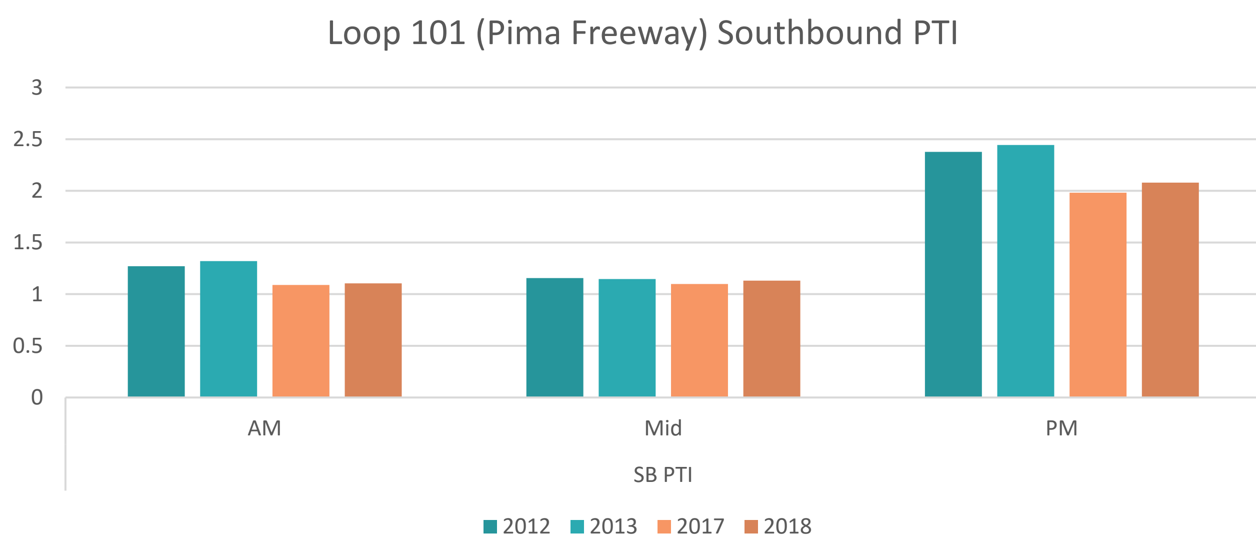


Chart 26 - Loop 101 (Pima Freeway) Southbound PTI 2010-2013, 2017-2018. Source: HERE

Safety

Examining safety data from before and after construction revealed no significant change in the pattern of reported crashes.

Arterial – University Drive: Sossaman Road to 88th Street

In 2016, the City of Mesa initiated efforts to widen the intersection of University Drive and Sossaman Road and reconstruct sections of the surrounding roadway. The project also included right of way acquisition, new right turn bays and an additional lane of travel on the south side of University Drive.

The project was estimated to take eight months to complete and was completed in early 2017.

Traffic Volumes

Traffic count information is limited given the size of the project. Counts from the years of 2011, 2015 and 2017 show uneven traffic volumes for the area though a marked increased following completion of the project.

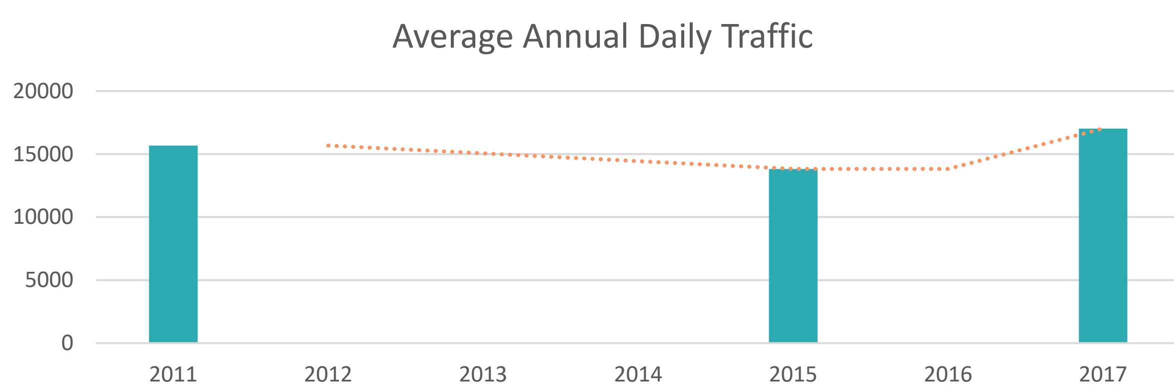


Chart 27 - University Drive Traffic Volumes, 2011, 2015, and 2017. Source: Agency Traffic Counts, MS2

Reliability Measures

Travel Time Index is a measure of the reliability of a roadway segment. It is presented as a ratio, where the lower number represents a more reliable travel time. It is not a measure of congestion and instead speaks to how reliably we can expect a facility to operate at a high level.

In Chart 30 and Chart 31, a clear increase in the TTI for all time periods indicate that roadways users can expect more reliable conditions following the completion of this project.

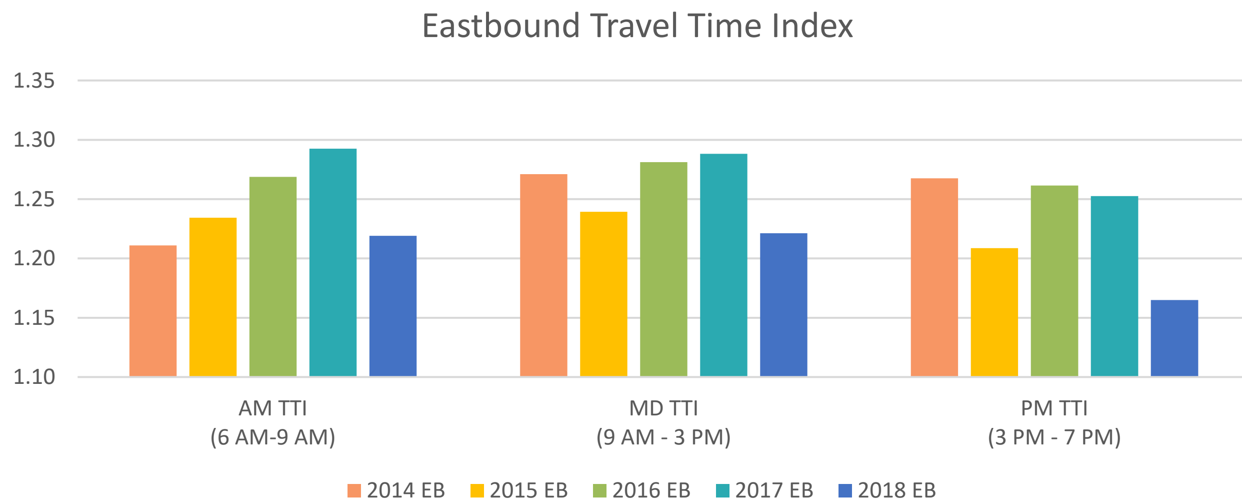


Chart 28 - University Drive Eastbound Travel Time Index 2014-2018. Source: HERE

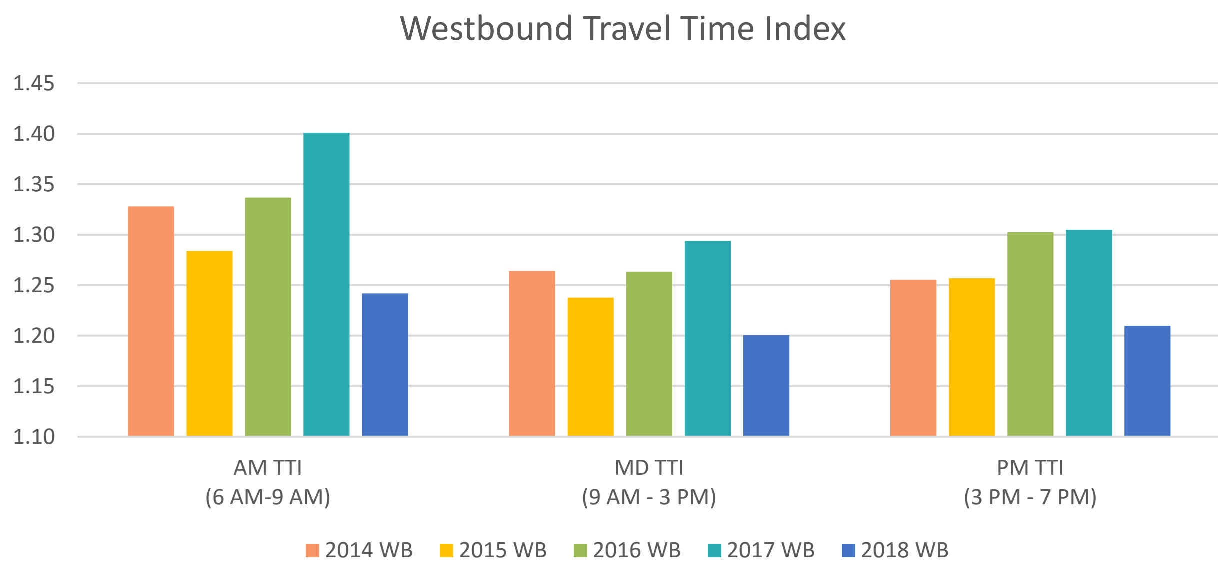


Chart 29 - University Drive Westbound Travel Time Index 2014-2018. Source: HERE

Safety

Examining safety data at this extreme granularity reveals few insights due to the small sample size. Anecdotally, it appears the location of accidents has shifted in response to some of the project elements. A more longitudinally and in-depth analysis would be required to definitively speak about the project's impacts.

Future of the Program

The Transportation Performance Program will continue to collaborate on MAG's next Regional Transportation Plan. As MAG looks towards a holistic approach to project development selection and programming, the program will continue to provide a vital connection in the process.

In addition to maintaining and setting federal performance targets, the program is also responsible for the evaluation of projects. This important work faces several challenges. Coordination with other programs to ensure project specific data is available will continue to be a focus of the program. As will creating a central repository for transportation specific data that will improve our ability to manage and access datasets from across the agency. Continuing to carefully curate the balance between quantitative and qualitative inputs in project selection remains among the highest priorities and greatest challenges for the program.

Emerging datasets and the advancement of data collection techniques will continue to advance the state of the practice and the Transportation Performance Program strives to evaluate and integrate new technologies whenever possible.

Appendix A – State & Federal Guidance

View complete texts and more information about relevant federal and state statutes by browsing the links below:

Proposition 400

Title 28 - Transportation
AZ Rev Stat § 42-6105 – County Transportation Excise Tax
AZ Rev Stat § 28-6303 – Regional Area Road Fund; Separate Accounts
AZ Rev Stat § 48-5103 – Public Transportation Fund
AZ Rev Stat § 28-6354 – Annual Report; Hearing; Priority Criteria

Federal Performance Measures

23 CFR 450.306: Scope of the metropolitan planning process
23 CFR 450.322: Congestion management process in transportation management areas
23 CFR 450. 324: Development and content of the metropolitan transportation plan
23 USC 119: National highway performance program
23 USC 134: Metropolitan transportation planning
23 USC 135: Statewide and nonmetropolitan transportation planning
23 USC 148: Highway safety improvement program
23 USC 149: Congestion mitigation and air quality improvement program
23 USC 150: National goals and performance management measures
23 USC 167: National highway freight program
23 USC 402: Highway safety programs
49 USC 5301: Policies and purposes
49 USC 5303: Metropolitan transportation planning
49 USC 5304: Statewide and nonmetropolitan transportation planning
49 USC 5310: Formula grants for the enhanced mobility of seniors and individuals with disabilities
49 USC 5326: Transit asset management
49 USC 5329: Public transportation safety program
49 USC 5335: National transit database
49 USC 70202: State freight plans

Appendix B – Transportation Performance Data & Sources

The Transportation Performance Program relies on a wide variety of data sets produced at different governmental levels. The list below includes a brief description of the datasets, an attachment to this document provides clarity for each dataset informs the measures produced by the program.

- **FHWA - Highway Performance Monitoring System (HPMS)** - The HPMS is a national-level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways. The HPMS contains administrative and extent of system information on all public roads, while information on other characteristics is represented in HPMS as a mix of universe and sample data for arterial and collector functional systems. Limited information on travel and paved miles is included in summary form for the lowest functional systems. HPMS was developed in 1978 as a continuing database, replacing the special biennial condition studies that had been conducted since 1965. The HPMS has been modified several times since its inception. Changes have been made to reflect changes in the highway systems, legislation, and national priorities, to reflect new technology, and to consolidate or streamline reporting requirements.[6]
- **ADOT - Freeway Monitoring System (FMS)** – The Arizona Department of Transportation (ADOT) is one of the leading public agencies in the nation in the realm of Intelligent Transportation Systems (ITS) and Freeway Management Systems (FMS). ADOT is taking advantage of the following intelligent infrastructure monitoring devices for management and operation of freeways[7]:
    - FMS devices in Phoenix region and Tucson area covering 490 directional miles of freeway
    - Over 415 data collection stations, collecting traffic data (i.e. Flow, Occupancy, speed) using various technologies
    - Over 360 ramp meters
    - A total of 208 Dynamic Message Signs (DMS) statewide to disseminate traffic, weather and advisory information to drivers on the road
    - A total of 284 CCTV to monitor and verify incidents, as well as coordinate with DPS
    - Road Weather Information Systems (RWIS) at 17 sites
    - Wrong-Way-Detection at 12 sites
    - Travel time displays in the Metro Phoenix and Metro Tucson areas on 82 DMS
- **FHWA - National Performance Management Research Data Set (NPMRDS) -** FHWA has acquired a second (v2) national data set of average travel times on the National Highway System for use in its performance measures and management activities. This

[6] https://www.fhwa.dot.gov/policyinformation/hpms.cfm. Accessed 8/30/2019.
[7] http://www.aztech.org/projects/adot-fms.htm. Accessed 8/30/2019

data set is also available to State Departments of Transportation and Metropolitan Planning Organizations to use for their performance management activities. The data set will be available monthly.[8]

- **University of Maryland's CATT Lab via FHWA Contract- Regional Integrated Transportation Information System (RITIS)** – RITIS is a situational awareness, data archiving, and analytics platform used by transportation officials, first responders, planners, researchers, and more. RITIS fuses data from many agencies, many systems, and even the private sector—enabling effective decision making for incident response and planning. Within RITIS are a broad portfolio of analytical tools and features. Ultimately, RITIS enables a wide range of capabilities and insights, reduces the cost of planning activities and conducting research, and breaks down the barriers within and between agencies for information sharing, collaboration, and coordination.[9]
- **ADOT - Accident Location Identification Surveillance System (ALISS)** – ALISS is a crash data archive for ADOT. The primary source of data for this database is the State Highway Log (SHL) system. The data is not "real time"[10].
- **HERE Data –** HERE captures location content such as road networks, buildings, parks and traffic patterns. It then sells or licenses that mapping content, along with navigation services and location solutions to other businesses such as Alpine, Garmin, BMW, Oracle, and Amazon.com. In addition, HERE provides platform services to smartphones. It provides location services through its own HERE applications, and also for GIS and government clients and other providers, such as Bing, Facebook, and Yahoo! Maps.[11]

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[8] https://ops.fhwa.dot.gov/perf_measurement/index.htm. Accessed 8/30/2019.
[9] https://ritis.org/intro. Accessed 8/30/2019.
[10] https://apps.azdot.gov/files/its-architecture/html/inv/el274.htm Accessed 2/3/2020.
[11] https://en.wikipedia.org/wiki/Here_(company). Accessed 9/16/2019

Appendix C – History of Performance Measures at MAG

The process of creating the Performance Management Program at MAG began in 2008 with the development of the Performance Measurement Framework and Congestion Management Update Study. The program was formally initiated in 2009 with the participation of MAG Member Agency modal committee representatives, as well as RTP partners including Arizona Department of Transportation (ADOT) and Valley Metro/Regional Public Transit Authority (RPTA). The intention of the program has been to provide a functional component that links planning and programming activities, using performance data and analysis. This process would introduce enhanced transparency and accountability, improving the quality of transportation investment decisions.

Beginning in 2010, the MAG Performance Management program began analyzing and reporting on observed speed and volume data reported by ADOT's Freeway Management Systems (FMS). These data are collected by a series of detectors including passive acoustic detectors and loop detectors which are embedded in the roadway. These reported data allow MAG to calculate and report on throughput, speed, lost productivity, and extent and duration of congestion. Due to the data collection methods, FMS data is provided for all individual lanes, including high occupancy vehicle (HOV) facilities.

Starting in 2011, MAG began obtaining speed data from Private Sector providers NAVTEQ (later re-named HERE). These speed-only data sets were/are obtained by Bluetooth detectors that connect to Bluetooth enabled vehicles and devices. Due to the inclusive nature of this detection process, these data provide full coverage of data for both the freeway and major arterial networks. Measures calculated from these data sets include speed, delay, congestion, Planning Time Index, and Travel Time Index. Unlike ADOT FMS data, the collection methods for these data do not allow for reporting on individual traffic lanes.

Beginning in 2012 with the Moving Ahead for Progress in the 21st Century Act (MAP-21) and continuing in 2015 with the Fixing America's Surface Transportation Act (FAST Act), the federal government has established rules for measuring performance and setting future targets on a system-level for states and MPOs.

Born from the Congestion Management Update Study, the Congestion Management Process (CMP) tool was designed to complement existing processes. The CMP Tool was built to consider RTP goals and objectives, and to score and rank projects accordingly. The base tool used both quantitative and qualitative criteria in its prioritization process, and has since been customized to the specific eligibility and funding requirements of various modal programs. To date, specific tools have been created to help program ALCP project changes, as well as project selections for the Pinal County Arterial and Bridge Program, Active Transportation Program, and Systems Management and Operations (SM&O) Program.